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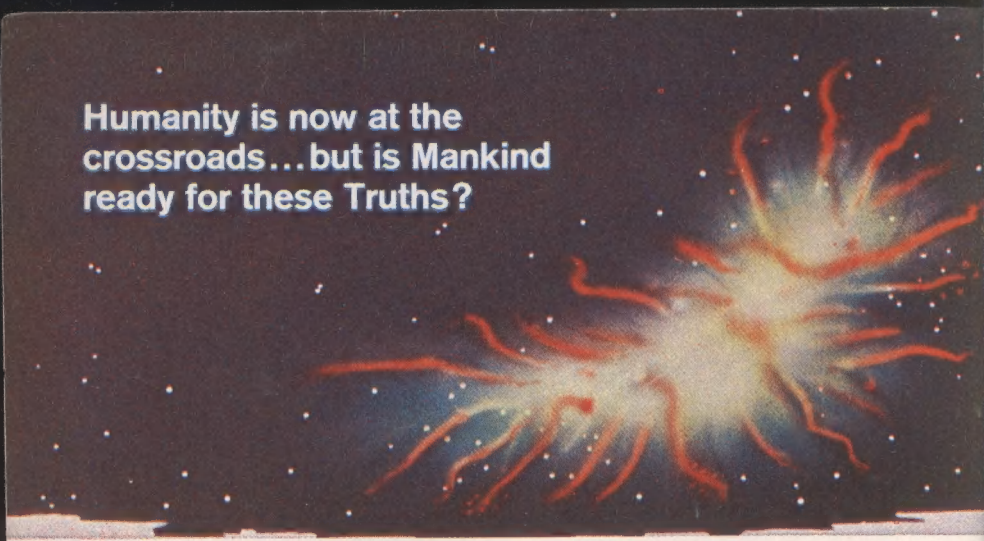

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SCIENCE DIGEST

Twenty-seventh year of publication

JUNE • 1963 VOL. 53, NO. 6

"Cleopatra," starring Elizabeth Taylor, the most talked about (and expensive) picture in history, has again aroused man's fascination with things Egyptian.

ARTICLES

BEHIND CLEOPATRA 5
WHY THEY DIG 11
CAMERAS: WHAT'S NEW, WHAT'S NEXT 16
THE MENTAL DIFFERENCES BETWEEN THE SEXES 21
HOW TO LIVE WITH MACHINES 26
LEUKEMIA: KEY TO THE CANCER PUZZLE? 31
72 HOURS TO THE MOON 37
THE RUSSIAN WHO TALKS BACK TO KHRUSHCHEV 45
STATUES THAT SEEM TO TALK 52
NEVER HAVE ENOUGH TIME? 55
THE NEW, EXCITING WORLD OF PSYCHICAL RESEARCH 58
FOOL YOUR FRIENDS WITH NUMBERS TRICKS 59
NEW MAPPER OF THE DEEP 65
WILTSHIRE BOULEVARD TO BROADWAY IN 60 MINUTES 66
BIG JOB FOR LITTLE MEN 74
MY FRIENDS THE RATS 79
BOOM TIME 84
ARE YOU TENSE? HERE'S WHY 85
WHEN STRANGERS MARRY ..... Inside Back Cover

FEATURES

LETTERS 2
THE CASE OF THE SUDDEN MURDERERS—What's on Your Mind? 41
WHY PEOPLE SMOKE—The Progress of Medicine 61
BUOYANCY, HOW HEAVY OBJECTS FLOAT—Your Science ABC's 69
HOW TO DATE A ROCK—Inventions, Patents, Processes 75
SCIENCE IN THE NEWS 91

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A moral outrage

We of the "National Chicken Watchin' and Poultry Protectin' Society" were horrified to read that scientists are promoting cannibalistic practices among our feathered friends ("Inventions, Patents, Processes"; April '63). The idea of feeding chickens ground up chicken feathers reeks of moral degradation.

Suppose they actually acquire an appetite for their own feathers? The sight of naked chickens frolicking about the barnyard nibbling at their few remaining feathers, might well prove a traumatic experience for our children. Suppose this trend spread to wild birds? Our highways would be cluttered with bare birds, migrating with each change of season.

In the name of decency, we beg them to halt this outrageous experiment before things get completely out of hand.

CLAUDE HARVEY
Adak, Alaska

Exercise for all

Dr. Sackett's claim ("Are We Drinking Too Much Milk?" April '63) that we drink too much milk is novel. If we overeat, we are going to suffer from excess fat and cholesterol. The remedy: healthy exercise! For those who are unable to engage in sports, setting-up exercises every morning are beneficial.

Does Dr. Sackett know the long-range effects of his theory? A hundred years from now? A thousand? Should everyone follow his theory, and cheat ourselves of milk, our bodies might become so degenerate and arthritic that the Communists need only to walk in the front door with no one able to stop them. God forbid that that should ever happen. An old motto is: "Work and pray." And work means exercise.

PETER DIESEL
Humboldt, Tenn.

Schliemann's language ability

In "A Science Milestone: Heinrich Schliemann," by Daniel Cohen (March '63), the author mentions that Schliemann had a special way of quickly learning foreign languages but he does not go into details.

J. K. RADICH
Phoenix, Ariz.

Schliemann's special method of learning languages was based on his very special memory. He would read and reread a book in the language he desired to learn plus a translation of that book in the language he already knew. This gave him a good basic grasp of the language; he could then round out his knowledge by getting some additional aid. The Archbishop of Athens, you will remember, helped teach him Greek. I doubt if too many of us could apply his methods successfully.—DANIEL COHEN

More than ever

A few years ago I picked up a copy of *Science Digest* in the library. Since I like science, I liked the magazine. Recently I subscribed and got my first issue, and now I like *Science Digest* more than ever.

RICHARD SARVER
Colfax, Wash.

Space age hysteria

It seems that you have been caught up in the wave of mass space-age hysteria that is sweeping our country. Just who or what will gain because of all this? Certainly not our present way of life, nor that of the generations to come. Even if we could live on the other planets, we could not go there fast enough to overcome our birth rate.

Why is there so much emphasis on the part of the military? A single

missile fired from any point on earth can strike any other point on earth within 15 minutes with no element of luck, since the target will not move relative to the firing point. How long would be required for a missile to reach a point on earth from even the nearest orbiting body?

The only possible reason for this folly is, perhaps, observation of weather, which man has been doing since time began and he can still do nothing except prepare for.

I'm trying to say you should come back to earth with the people, and tell us of things that are going on here in which we are interested. Tell us of life in the sea, how steel and glass are manufactured, and why houses are built with square corners. I'm sure others will be as grateful as I.

FELIX CHILDRE
Lillwin, Ala.

From the bottom of the deck

Commenting on "Life on Unseen Planets," Aaron Reeder ("Letters," April '63) contradicts Dr. Harlow Shapley, who includes as a requirement for the beginning of life "plenty of time for biochemical evolution": "If (the scientists') theory is right, then they can create life, and they should be able to do it instantly, for they already have all the ingredients," says Mr. Reeder.

If his contention is right, he should be able to deal a well shuffled pack of cards so that each player gets all 13 cards of his (bridge) hand in one color, red or black, and he should be able to do so instantly, for he has the two ingredients of red and black cards. I do not ask for dealing each player one suit, nor do I introduce complicating factors of seating, etc. etc., but recommend nevertheless that Mr. Reeder ask about the permutative probabilities before attempting to finish such a task.

P. KEMPLER
Steubenville, Ohio

Reader at 82

This is a compliment regarding the steady improvement in *Science Digest*. It may interest you to learn that my mother, an exceptional person, considered *Science Digest* her favorite when she was just past 93. At 82 I seem to be following her example.

H. L. PUGH
Cleveland, Ohio

So what's new?

What is so new about the Russian method of water injection? (Science Around the World,, April '63). In the Phoenix, Arizona, area plastic tubing with an aluminum rod for water injection under the plant roots has been on sale for many years. There is extensive open water irrigation out here in this part of the country and it is still favored over the injection method because of the higher man-hours involved in moving around the tubing.

JOHN SHULNES
Luke AFB, Ariz.

The layman can understand

I would like to thank and congratulate you on your fine magazine. It is, to my knowledge, the only scientific magazine that the average layman can understand and profit by.

ERIC MARENGHI
Hartford, Conn.

The meeting of three great cultures provides the background for the movie "Cleopatra." Caesar (Rex Harrison) the Roman general, examines a zoetrope, a moving picture device from Greece. Cleopatra (Elizabeth Taylor) presides in regal Egyptian dress.

Behind Cleopatra

by Daniel Cohen

A RICH panorama of ancient Egypt's splendor and sophisticated culture will unfold when the movie *Cleopatra* opens in New York on June 12. Yet the film amounts to hardly more than a teaser when

compared to the full story of this civilization that flourished thousands of years before Christ.

As the pictures on these pages indicate, civilization in Egypt had progressed to extraordinary heights by the time the Romans arrived. When Caesar met Cleopatra, Egypt had been a going concern for over three thousand years.

Cleopatra, incidentally, was not a single person. The name Cleopatra was the traditional one given to queens of Egypt under the Ptolemic dynasty (and there were 32 dynasties in all). The one that history (and Twentieth Century Fox) makes much of was Cleopatra Auletes, the beautiful, shrewd and powerful daughter of Ptolemy XI.

In this ever-changing world, it's hard to grasp the antiquity of the kingdom Cleopatra ruled in its waning days. The facts are these:

The Egyptian state began about 3200 B.C., with a Pharaoh known to legend as Menes. The long thread of its history was finally broken in 30 B.C., when Augustus Caesar incorporated the land of the Nile into the Roman Empire.

Ancient Egypt was the longest-

Cleopatra's fabled barge was reconstructed for the movie. Although Cleopatra ruled at the end of Egypt's history the richness and beauty of the civilization contrasted with the relative austerity of the Romans who were just beginning their empire building.

lived state of the ancient world.

The basic reason Egypt is so well known is that so much of it has been preserved by the hot, dry North African sands.

Over 13 centuries separate the building of the most famous Egyptian monument, the Great Pyramid of Cheops, and Rameses' colossus at Abu Simbel (now very much in the news because of its imminent disappearance beneath the waters of the Aswan Dam.)

The oldest tourists

It is not too surprising that the first people to be fascinated by ancient Egypt were the ancient Egyptians themselves. By 1500 B.C. many older structures were regarded as national monuments and opened to sightseers. The scribblings that these ancient tourists left on the walls of these monuments show that they were very much like their modern counterparts.

Priests spent centuries trying to save the tombs of earlier rulers from desecration by resourceful tomb robbers. Unfortunately for the Pharaohs and posterity the robbers were more successful than the priests, and managed to plunder about 99 percent of all the tombs.

Egypt enjoyed such a long history because of its isolation. Look at it on the map. To the north and east it is protected by the seas, to the south and west by the deserts of Sudan and Libya. The country itself was a fertile strip running through the desert on both sides of the Nile.

Alexandria, Egypt, was the center of the Greek-influenced or Hellenistic world, and as such the center of invention. Two products of ancient ingenuity shown in the movie are an Astrolobe, (top) forerunner of the sextant, and a crude telescope.

Each year with precise regularity the Nile overflows its banks bringing black earth from the heart of Africa and turning an arid waste into a lush oasis.

Egypt's isolation freed her from the constant threat of invasion which haunted so many other societies and turned them into nations of warriors and walled cities. But conquests did come. In early times

the barbaric Hyksos swept down through Palestine and became rulers for a period. Much later, during Egypt's decline, it was conquered by the Assyrians and Persians.

When Alexander the Great entered Egypt in 332 B.C. he was welcomed as a deliverer. After Alexander's death his empire was divided and the rule of Egypt passed into the hands of Ptolemy, the son of one of Alexander's generals. Under Ptolemy and his descendants, Egypt and in particular Alexandria became the center of the Hellenistic world. But Greek culture never penetrated the tradition-bound Egyptian society very deeply. It always remained a thin covering on much older base.

Down with the Sphinx

Egypt was completely severed from her ancient past when in 693 A.D. it was conquered by the Arabs and converted to an Islamic state. The Moslems regarded the old monuments the work of infidels, and used some of them as a source for stone for building mosques. One, Sheikh Mohammed, even mutilated the Great Sphinx at Giza thinking that it would please God. In recent years, however, the government of the United Arab Republic has shown a greater interest in preserving its heritage. Although much history will doubtless be swept away by the UAR's attempts to modernize, they are at least giving the scholars and scientists a chance to save what they can.

Modern study of Egypt was begun by no less a figure than Napoleon. At the battle of the Pyramids he exhorted his troops with the words, "Soldiers, forty centuries look down upon you." This was no mere pep talk—Napoleon had a genuine interest in Egyptology. Included in his army of the Nile were some 200 learned men who launched the first systematic study of Egypt. Napoleon's invasion was a military failure, but for science it was a triumph. One of these learned men, Vivant Denon, an artist whose previous contribution to culture had been to produce a wealth of pornographic drawings, created a lively stir in Europe when he issued 36 volumes of drawings of Egyptian monuments.

But the elaborate carvings so meticulously copied by Denon, meant nothing to those who saw them. The secret of deciphering the hieroglyphics had been lost. The monuments of the Pharaohs were mute until a brilliant young French scholar, Jean Francois Champollion, found the key to this system of writing.

The discovery, in 1922, of the unplundered tomb of Tut-ankh-Amen, an obscure Pharaoh of the XVIIIth dynasty gave renewed vigor to public interest in Egyptology (see page 11). If the tomb of a minor ruler, one whose only distinction was that he had escaped the notice of the crafty plunderers, could contain such riches, what had this civilization been like?

Unfortunately the popular image that has come down to us is of a

mysterious, cruel and morbid society, riddled with mummies' curses and strewn with the bodies of slaves who had been whipped to death to build the tombs of the Pharaohs.

Much of the mysterious cast of Egyptian society came from their extreme conservatism, and unwillingness to abandon old gods or traditions. In a society that exists as long as Egypt did this can lead to a bewildering religious setup. The priests were constantly "identifying" old gods with new ones or combining gods and making them different "aspects" of a single god. This patchwork theology didn't seem to bother the faithful, though the modern man who tries to find a logical pattern is apt to feel that he is confronted with a totally alien mind.

Despite the influence of the Greeks, Egypt remained devoted to her old gods as this temple scene from "Cleopatra" shows.

The reputation for cruelty is also unjustified. Slavery existed, although it was not nearly as widespread as many people think, and all people were subject to the whim of the Pharaoh who was both ruler and god. But until comparatively recent times most societies were ruled this way. The Pharaoh could not be willful for he too was bound by tradition and the Egyptian ideal of "justice." There is no evidence that the practice of human sacrifice was common among the Egyptians, as it was in many other Middle Eastern and early American civilizations. Nor did the Egyptians particularly delight in torture or the bloody glory of war. They found more joy in a good harvest than in enemies slain on the battlefield.

The workmen on the Pyramids were probably not slaves but farmers conscripted to work during the season of the annual flood when they otherwise would have been idle. We must also remember that the workmen were not just building a tomb for their king, they were building a monument to a god. It has even been suggested that their attitude was not much different from that which moved the peasants of the middle ages to labor so lovingly on the great cathedrals.

The overpowering magnificence of the Pyramids has shaped much of the popular thinking about Egypt. In fact you are probably carrying a

picture of the Great Pyramid in your pocket right now. It is part of the Great Seal of the United States printed on the back of the dollar bill. No other structures have had so many legends attached to them.

The Pyramids are truly wonders —of engineering, but there is no particular mystery about the way they were built. Suggestions that the Egyptians used levitation or possessed some secret "pyramid lever" to raise the great stones are nonsense. They used three things in their construction: plenty of time, plenty of labor, and a large body of sound engineering knowledge.

The structure and placement of the Pyramids probably had some religious significance—to the Egyptians. But even the Pharaoh Cheops would blush if he could hear some of the claims that have been attached to his last resting place. "Pyramidologists" have worked out elaborate theories, showing that events of the past and future have been foretold by interpretating various measurements of the Great Pyramid. The Great Pyramid is a large structure; there are a lot of things in it and on it that can be measured. It only takes patience and ingenuity to relate some of these measurements to events in history.

Yet who hasn't experienced a little thrill of fear when first entering the Egyptian room of a museum. It's not just that the cases contain bodies of people who have been dead for thousands of years, but what scares us is that they are mummies!

The bodies were so carefully wrapped and elaborately buried we begin to think Egypt was a death centered society. It was nothing of the kind. Look closely at the tomb paintings. There is nothing morbid about them. Along with traditional religious scenes are scenes of harvesting, hunting and fishing; of acrobats performing for the king; of bread making and feasting. In short, scenes of a full, rich and joyful life. By their elaborate burial customs the Egyptians hoped to be able to continue their good life on earth after death.

Permanence, peace and an abundant life—these are the elements that truly characterize Egyptian society, and among the antiquities of man, few can compare with those of ancient Egypt in giving a perspective of man's span on this planet.

The modern science of archaeology has uncovered most of what we know about ancient Egypt. For the story of one of the most exciting moments in Egyptian archaeology, see the following pages.

A Science Classic

Photo, Harry Burton, The Metropolitan Museum of Art

Buried in a gold coffin, inside a gold filled tomb the body of the Pharaoh Tut-ankh-Amen lay untouched for centuries until, in 1922, a British archaeological team led by Howard Carter and Lord Carnarvon found the tomb. Here Carter and a native examine the coffin, which is in the form of an effigy of the boy king.

Why they dig

The day following (26 November) was the day of days, the most wonderful that I have ever lived through, and certainly one whose like I can never hope to see again. Throughout the morning the work of clearing continued, slowly perforce, on account of the delicate objects that were mixed with the filling. Then, in the middle of the afternoon, thirty feet down from the outer door, we came upon a second sealed

doorway, almost an exact replica of the first. The seal impressions in this case were less distinct, but still recognizable as those of Tut-ankh-Amen and of the royal necropolis. We were firmly convinced by this time that it was a cache that we were about to open, and not a tomb.

We were soon to know. There lay the sealed doorway, and behind it was the answer to the question.

Slowly, desperately slowly it seemed to us as we watched, the remains of passage debris that encumbered the lower part of the doorway were removed, until at last we had the whole door clear before us. The decisive moment had arrived.

ITH trembling hands I made a tiny breach in the upper left-hand corner. Darkness and blank space, as far as an iron testing-rod could reach, showed that whatever lay beyond was empty and not filled like the passage we had just cleared. Candle tests were applied as a precaution against possible foul gases, and then, widening the hole a little, I inserted the candle and peered in, Lord Carnarvon, Lady Evelyn, and Callender standing anxiously beside me to hear the verdict. At first I could see nothing, the hot air escaping from the chamber causing the candle flame to flicker, but presently, as my eyes grew accustomed to the light, details of the room within emerged slowly from the mist, strange animals, statues, and gold—everywhere the glint of gold. For the moment — an eternity it must have seemed to the others standing by—I was struck dumb with amazement, and when Lord Carnarvon, unable to stand the suspense any longer, inquired anxiously, "Can you see anything?" it was all I could do to get out the words, "Yes, wonderful things." Then, widening the hole a little further, so that we both could see, we inserted an electric torch.

The thrill of archaeological discovery has rarely been more excitingly told then in this account by British Archaeologist Howard Carter of the moment, in 1922, when he became the first modern man to enter the tomb of King Tut-ankh-Amen, who lived and died in Egypt in the 14th Century B.C. (Excerpted from "The Tomb of Tut-ankh-Amen," by Howard Carter, Copyright by Cassell & Company, Ltd., and reprinted with their permission.)

I suppose most excavators would confess to a feeling of awe—embarrassment almost—when they break into a chamber closed and sealed by pious hands so many centuries ago. For the moment, time as a factor in human life has lost its meaning. Three thousand, four thousand years maybe, have passed and gone since human feet last trod the floor on which you stand, and yet, as you note the signs of recent life around you—the half-filled bowl of mortar for the door, the blackened

"Never in the history of excavation had such a sight been seen."

lamp, the finger-mark upon the freshly painted surface, the farewell garland dropped upon the threshold —you feel it might have been but yesterday. The very air you breathe, unchanged throughout the centuries, you share with those who laid the mummy to its rest. Time is annihilated by little intimate details such as these, and you feel an intruder.

That is perhaps the first and dominant sensation, but others follow thick and fast—the exhilaration of discovery, the fever of suspense, the almost overmastering impulse, born of curiosity, to break down seals and lift the lids of boxes, the thought—pure joy to the investigator—that you are about to add a page to history, or solve some problem of research, the strained expectancy—why not confess it?—of the treasure-seeker.

SURELY never before in the whole history of excavation had such an amazing sight been seen as the light of our torch revealed to us. Let [the reader] imagine how they appeared to us as we looked down upon them from our spy-hole in the blocked doorway, casting the beam of light from our torch—the first light that had pierced the darkness of the chamber for three thousand years—from one group of objects to another. The effect was bewildering, overwhelming. I suppose we had never formulated exactly in our minds just what we had expected or hoped to see, but certainly we had never dreamed of anything like this, a roomful—a whole museumful, it seemed—of objects.

Gradually the scene grew clearer, and we could pick out individual objects. First, right opposite to us —we had been conscious of them all the while, but refused to believe in them—were three gilt couches, their sides carved in the form of monstrous animals, curiously attenuated in body, as they had to be to serve their purpose, but with heads of startling realism. Uncanny beasts enough to look upon at any time: seen as we saw them, their brilliant gilded surfaces picked out of the darkness by our electric torch, as though by limelight, their heads throwing grotesque, distorted shadows on the wall behind them, they were almost terrifying. Next, on the right, two statues caught and held our attention; two life-sized figures of a king in black, facing each other like sentinels, gold kilted, gold sandalled, armed with mace and staff, the protective sacred cobra upon their foreheads.

These were the dominant objects that caught the eye at first. Between them, around them, piled on top of them, there were countless others—exquisitely painted and inlaid caskets; alabaster vases, some beautifully carved in open-work designs; strange black shrines, from the open door of one a great gilt

snake peeping out; bouquets of flowers or leaves; beds; chairs, beautifully carved; a golden inlaid throne; a heap of curious white oviform [egg-shaped] boxes; staves of all shapes and designs; beneath our eyes, on the very threshold of the chamber, a beautiful lotiform [lotus-shaped] cup of translucent alabaster; on the left a confused pile of overturned chariots, glistening with gold and inlay; and peeping from behind them another portrait of the king.

Presently it dawned upon our bewildered brains that in all this medley of objects before us there was no coffin or trace of a mummy, and the much-debated question of tomb or cache began to intrigue us afresh. With this question in view we re-examined the scene before us, and noticed for the first time that between the two black sentinel statues on the right there was another sealed doorway.

THE explanation gradually dawned upon us. We were but on the threshold of our discovery. What we saw was merely an antechamber. Behind the guarded door there were to be other chambers, possibly a succession of them, and in one of them, beyond any shadow of doubt, in all his magnificent panoply of death, we should find the Pharaoh lying.

Our natural impulse was to break down the door, and get to the bottom of the matter at once, but it was imperative that a plan and

"The tackle for raising the lid was in position. I gave the word."

complete photographic record should be made before anything was touched.

We now turn to the contents of the Burial Chamber.

At the eastern end of the shrine were two massive folding doors, closed with ebony bolts shot into copper staples, their panels decorated with strange figures—headless demon guardians of the caverns of the Underworld.

When we drew back those ebony bolts of the great shrine, the doors swung back as if only closed yesterday, and revealed within yet another shrine, in type like the first, save for the blue inlay. It has similar bolted doors, but upon them was a seal intact, bearing the name of Tut-ankh-Amen and a recumbent jackal over Egypt's nine foes. The doors of this second shrine were bolted top and bottom, carefully fastened with cord tied with metal staples, and sealed.

It was with great care that the cords were severed and those folding doors opened, which, when swung back, revealed yet a third shrine, also sealed and intact—the seal impressions upon this third shrine being identical to those on the second.

It was an exciting moment in our arduous task that cannot easily be forgotten. We were to witness a spectacle such as no other man in

our times has been privileged to see. With suppressed excitement I carefully cut the cord, removed the precious seal, drew back the bolts, and opened the doors, when a fourth shrine was revealed, similar in design and even more brilliant in workmanship than the last. The decisive moment was at hand! An indescribable moment for an archaeologist! What was beneath and what did that fourth shrine contain? With intense excitement I drew back the bolts of the last and unsealed doors; they slowly swung open, and there, filling the entire area within, effectually barring any further progress, stood an immense yellow sarcophagus, with the lid still firmly fixed in its place, just as the pious hands had left it.

It was on February 3 that we first had a clear view of this sepulchral masterpiece, ranking as it does among the finest specimens of its kind the world possesses.

With the profound silence that reigned the emotion deepened, the past and present seemed to meet—time to stand and wait, and one asked oneself, was it not yesterday that, with pomp and ceremony, they had laid the young king [Tut-ankh-Amen died when he was about 18] in that casket?—so fresh, so seemingly recent were those touching claims on our pity that, the more we gazed on them, the more the illusion gathered strength.

The tackle for raising the lid was in position. I gave the word. Amid intense silence the huge slab, broken in two, weighing over a ton and a quarter, rose from its bed. The light shone into the sarcophagus.

The contents were completely covered by fine linen shrouds. The lid being suspended in mid-air, we rolled back those covering shrouds, one by one, and as the last was removed a gasp of wonderment escaped our lips, so gorgeous was the sight that met our eyes: a golden effigy of the young boy king, of most magnificent workmanship, filled the whole of the interior of the sarcophagus. This was the lid of a wonderful anthropoid coffin, some 7 feet in length, resting upon a low bier in the form of a lion, and no doubt the outermost coffin of a series of coffins, nested one within the other, enclosing the mortal remains of the king.

Upon the forehead of this recumbent figure of the young boy king were two emblems delicately worked in brilliant inlay—the Cobra and the Vulture—symbols of Upper and Lower Egypt, but perhaps the most touching by its human simplicity was the tiny wreath of flowers around these symbols, as it pleased us to think, the last offering of the widowed girl queen to her husband.

Among all that regal splendor, that royal magnificence — everywhere the glint of gold—there was nothing so beautiful as those few withered flowers, still retaining their tinge of color. They told us what a short period three thousand three hundred years really was — but Yesterday and the Morrow.

Cameras: what's new, what's next

by Bruce H. Frisch

PHOTOGRAPHIC advances have come streaming out of drafting rooms and research labs so fast in recent years that the casual photographer gets lost in the forest of "break throughs." To bring you up to date *Science Digest* has put together this roundup of what's new, what's planned for the near future, and what may be coming in the years ahead.

Is it really automatic?

The new automated cameras have made the hardest part of photography finding out what is meant by the catchword "automatic."

First, there is the nonautomatic "automatic" electric eye system. You read the built-in meter and set the camera yourself. The manufacturer has simply removed the meter from around your neck and attached it to the camera.

Next, there is the matching system. You still make the camera adjustments by aligning the meter needle with a second needle or reference mark (Miranda Automex, $299.95).

The largest number of electric eyes adjust either the diaphragm (Yashica Flash-O-Set, $55) or the shutter, but not both.

Finally, there are only ten or a dozen cameras with true fully automatic exposure control. These adjust both diaphragm and shutter (Fujica Auto-M, $89.95). The trend is definitely in this direction.

Cadmium sulfide meters are the latest kind, but only a few cameras have them so far (Taron Marquis, $79.95). They read in dimmer light and are usually more accurate. Cadmium sulfide is a compound which offers less resistance to the flow of electricity, the brighter the light.

Two off-camera meters give readings in moonlight (Gossen Lunasix, $63). Such high sensitivity has made possible cheaper models of the spot meter (Heiland Pentax 3°/21°, $99.50). With these you can read the brightness of a small part of a scene from a distance through a built-in telescope. At plays, nightclubs and night sports these are especially handy.

Designers are working on ways to put a spot meter inside cameras with ground glass viewers. You would center the cadmium sulfide dot over the area of the image on the ground glass you wanted to measure. There will also be meters that will measure the whole image. Only the part of a scene viewed by the lens, telephoto or whatever, will then determine exposure, giving greater accuracy.

What's new in lenses

Zoom lenses are finally approaching the $100 barrier (Argus, 85 mm to 145 mm, $120). Familiar from TV, zooms give variable magnification.

A different kind of telephoto lens is constructed of mirrors instead of refracting glass. Advantages are shortness and lightness (500 mm Reflex-Nikkor, $450). Future developments should put them within range of the average budget.

The color picture

Polaroid's instant Polacolor (roll for six 3¼ in. x 4¼ in. prints, $4.25) has drawn cheers and grumbles. Cheers for a color print material twice as sensitive as Kodacolor, grumbles at other manufacturers. Why, photographers ask, if Polaroid can make a color film which develops in one minute inside the camera, can't someone make a color film that is easy to process in the darkroom?

Expectations are that both color processing and printing can be made almost, but not quite, as easy as black and white.

Several conventional foreign and U.S. color films have been introduced here in the yast year (Agfachrome and others for slides, FR for prints). Although none are very different from films that were already available, they widen the choice of color feel.

A new U.S. brand, Dynachrome, has cut the cost for film, processing and mounting of 20 transparencies to $2.75.

Commander Alan Shephard used Ultra Speed Anscochrome during his suborbital flight in 1961. It is now available for movies but not for still cameras. Ultra Speed is more sensitive to light than High Speed Ektachrome, and if processed for it, gives good results when used as if it were twice as sensitive as it is.

Shooting b & w and color

Perhaps after shooting a few pictures on a new roll of color film you will decide to switch to black and white. At present there is no way to do this without rewinding, reloading and ruining a few frames of film. A few very expensive cameras offer interchangeable backs which can be quickly removed in mid-roll with the film sealed inside (Contaflex Super, $219; back, $49). Other manufacturers may follow suit.

Kodak has just come out with a series of magazine-loading cameras (four Instamatics, $16 to $110). The magazines can be easily removed in mid-roll, but not without spoiling some film. Its real purpose is to eliminate threading and rewinding.

Printing the picture

Printing machines for the home promise shortcuts. However, those introduced for black and white (Rollaprint, $37.50) have not given very high quality. The Pavelle Corp. has shown a promising prototype machine for color. Public sale by Xerox is fairly sure; when is uncertain. Best guess on price is $150 to $200.

Another kind of machine projects an enlarged positive image of a negative on a screen to give a pre-

Eraseable film

PREVIEW of the photographic future: photoconductive plastic. It does not have to be kept in the dark, and can be erased and reused about a dozen times. Almost instantaneous development requires no chemicals. Here's how it works. Opposite sides of the film are given opposite electric charges. Where light strikes, the film charges are neutralized. The film is heated, then cooled, in 1/10 to 1/100 second, preserving the pattern of remaining charges as a pattern of depressions. At left is the dimpled image of a pin photographed against a screen. The inventor, Dr. Joseph Gaynor of General Electric, points out that although the plastic film captures such small details that a microfilmed law library would fit in a drawer, it is not now as sensitive to light as ordinary film. Other drawbacks: To make a print, the image on the plastic must be photographed by conventional means; to show it as a black and white slide, you need a special projector.

view of what the print will look like. It is still high-priced (Ricoh Reversascope, $279.50), but opens up the possibility of a future inexpensive hand viewer.

Machine-gun photography

For those who can't use film fast enough there have been an increasing number of motorized cameras with firing rates running from ten frames per second (in the first second for Robot Royal 24S, $329) to one frame every three seconds. They operate on gas, spring or electric power. Not all shoot continuously when you hold the button down. With some, you must trip the shutter after the motor drive has advanced the film and cocked the shutter. Price range is enormous; about $80 to $800 (Yashica Sequelle half-frame, $80).

Gadgets galore

Probably the two most automated cameras are the Fotron (about $130) and the new Kodak Instamatic 400 ($53). Each has magazine loading, motorized film advance, a variety of automatic exposure control, built-in flash and other features. The Fotron focuses by motor when you push one of three buttons for the distance of the subject. Both cameras sound alike, but aren't. Check the differences.

As more and more automation has been piled on, once compact cameras have contracted elephantiasis. In a move back to compactness, manufacturers have reduced the standard 35mm still camera negative to half size (3¼ in. x 1 in.) and the size of the camera down to where it can fit in your palm. Most are simple and economically priced (Olympus Pen, $34.50), but scaled-down versions of the professional-quality 35's are expected soon.

Soviet competition

Speaking of economy, the Japanese slashed camera prices. Now the Soviets have started exporting cameras at even lower prices, although not with the up-to-date Japanese design. So far Soviet cameras have reached Britain, but not the U.S. (Zenith 3, $75).

Shape of the future

What are the possibilities for the far future? Automatic electronic focussing, already built into a prototype camera. Cameras taking a larger negative than 35mm, but with the same portability and ease of operation. Film of light-sensitive plastic, an outgrowth of present government-sponsored research. Pictures first caught on a glowing screen, then transferred to film. Eventually, perhaps, pictures recorded on magnetic tape as TV is.

One thing is sure: There are surprises in store for even the most imaginative forecaster.

Moon dust is all around us

SCIENTISTS are spending millions of dollars on intricate rockets and spacecraft to explore the moon. But they could simply step out of their laboratory and scoop up bits of the moon for testing—if they know what to look for.

This paradox results, the National Geographic Society says, from the fact that the moon has no atmosphere to shield it from meteors. Smashing unhindered into its surface, they actually explode the rock, leaving characteristic craters.

Some fragments of the moon are hurled away so fast they escape its gravity, which is only one-sixth that of the earth. Captured by earth's gravity, these specks settle slowly to the surface, according to lunar experts. But there is no way of identifying the particles that originated on the moon.

The mental differences between the sexes

by Gene Marine

Why do so few women succeed intellectually? Is it because they can't think —or because they're not allowed to?

WOMEN are the victims of a cultural stereotype, but this is because they themselves insist on it and like it that way. They can break loose, individually, and begin to attain their potential only when they are willing to look a few conventions in the eye—and spit.

These were points made by Stanford psychologist Eleanor Maccoby, and author-poet Marya Mannes at a recent symposium on "The Potential of Woman," sponsored by the San Francisco Medical Center of California. They got some strong backing from other scientists at the symposium.

Before they can break loose on any large scale, a lot of both men and women are going to have to learn that the distinction between "man" and "woman" is not so obvious as we might think, even physically.

There are, of course, differences, both in capacity and in accomplishment. The first part of Dr. Maccoby's paper described some of these differences, notably as they have been revealed during the last thirty or forty years—ever since "large numbers of women have had opportunities for higher education opened to them:

"A Madame Curie is conspicuous by her very rarity. Even in the field of letters . . . we have more

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men than women who are productive, creative writers. When it comes to achievement in science, the imbalance is much greater. Our colleges produce very few women who become intellectually excited by, or immersed in, a scientific problem; or who organize large bodies of diverse data into a new theoretical statement."

Dr. Maccoby cited a 1956 study of 400 Radcliffe Ph.D's showing that women publish substantially less than men of comparable jobs and rank, and that about half the women with doctorates had published little or nothing at all. Marriage and childbearing have nothing to do with this. The study shows that the women who had married had published as much as those who had not.

What's the difference?

Is there some inherent difference between men and women that is functioning here?

There are certainly test differences. After the 5th or 6th grade, for instance, girls excel over boys in measure of "verbal fluency." That means that they write longer themes, or they can think of more words starting with "pa" in fifteen seconds, or they tell longer stories about stimulus pictures.

Boys, on the other hand, collect the prizes in mathematics once arithmetic is past. In analytic geometry, trigonometry, algebra and quantitative reason, it's boys all the way—averaging about fifty points higher on scholastic-aptitude tests for college admissions. This could be because girls—not intending to be physicists or engineers—just don't care about working at math; but it could be because they "lack certain abstract or analytical qualities of mind."

Try this one

Try this test—the idea being to figure out how the series is formed, and then to name the next number in the series:

2, 4, 6, 8 . . . . .

Of course it's 10. Now try 2, 4, 8, 16, 32. . . Get that one? Okay, now try this one: 14, 23, 34, 42, 51, 59, 72. . . .

With apologies to Californians, the next number is 81, and the series of stops on New York's 8th Avenue subway. Even New Yorkers probably didn't recognize it, because you were set for a different kind of series. Any human being has difficulty "breaking set"—but women have more difficulty than men.

Newspapers used to print line drawings of landscapes, out of which you were supposed to pick a human face. This is an "embedded figures" test, and you have to "break the set" of the landscape to find the face. There are also spatial tests—for instance, how many surfaces are visible on the other side of a pile of cubes? People who are good at breaking sets are called (from the embedded-figures test) "figure-dependent"; people who aren't are called "field-dependent."

"The key to the matter is whether, and how soon, a child is encouraged to assume initiative, to take responsibility."

—Dr. Eleanor Maccoby

All these things go together, statistically: figure-dependence, mathematical skill and analytic intelligence on the one hand; field-dependence, verbal skill, and what's called "global" intelligence—intelligence that focuses on a whole scene rather than on details—on the other. Dr. Maccoby goes on:

"I suggest that girls on the average develop a somewhat different way of handling incoming information—that their thinking is less analytic, more global and more perseverative—and that this kind of thinking may serve them very well for many kinds of functioning, but that it is not the kind of thinking most conductive to high-level intellectual productivity, especially in science. . .There are many women who think analytically, and many men who do not, but there are consistent differences in the average performance of the two sexes."

Dr. Maccoby, not content with reporting differences, went on to talk about how the differences get different. Overprotected boys were found in one study to be good in language work, bad at math. Another study, testing for field-and-figure dependence, found that the more analytic children had the most freedom at home, while the field-dependents had mothers with strong apron strings. Some children's IQs rise between pre-school years and the age of ten; some go down. Those whose scores go up are "competitive, self-assertive, independent and dominant;" the others are "passive, shy and dependent."

Dr. Maccoby began to approach her point:

"The key to the matter seems to lie in whether, and how soon, a child is encouraged to assume initiative, to take responsibility for himself, and solve problems by himself, rather than relying upon others for the direction of his activities."

"Women are obsessed with an ideal of femininity as the guarantee of happiness. Be thin, be smart, be gay, be sexy."

—Marya Mannes

The psychologist went on to note that analytic, figure-dependent women tend to have had "an unusually close relationship with their fathers, rather than their mothers," when growing up, and tend "to be low in acceptance of authority."

Girls who do well at analytic thinking, Dr. Maccoby said, "are not very feminine creatures, at least not according to the standards our present society sets." She coupled this with the fact that girls "are more greatly influenced by the opinions of others" than are boys, that girls conform more "to what they perceive to be the social demands.

"It is probably these conformist tendencies that help them to excel at spelling and punctuation—the kinds of performance for which there is only one, socially prescribed, right answer. But for higher-level intellectual productivity, it is independence of mind that is required."

The curious, exploratory, dominant, independent little girl, who likes to play with boys and doesn't dig dolls, eventually has to go to school, where the boys won't play with her any more and where she finds out that she isn't acting as little girls are supposed to act. To put it differently, if she is to maintain "the qualities of dominance, independence and active striving that appear to be requisites for good analytic thinking," she has to defy conventions—to act, if you will, un-girl-like.

"She may do this successfully, in many ways, but I suggest that it is a rare intellectual woman who will not have paid a price for it— a price in anxiety. And I hazard the guess that it is this anxiety which helps to account for the lack of productivity among those women who do make intellectual careers.

"I wonder whether our current social definition of the feminine woman and girl could not undergo

some revisions without any damage to the essential functions of women. Does a woman really need to be passive and dependent in order to be sexually attractive to men, or in order to be a good mother? Could we not accept and encourage the active, dominant, independent qualities of the intellectual girl without labeling her as masculine, and encourage in her whatever aspects of femininity are compatible with an analytic quality of mind? I recognize that I am raising some controversial and intricate issues here. . ."

Now it was the turn of Miss Mannes:

"*...Women are obsessed with an ideal of femininity as the guarantee of happiness. Be thin, be smart, be gay, be sexy, be soft-spoken. Get new slip-covers, learn new recipes, have bright children, further your man's career, help the community, drive the car, smile.*"

Into the mold

The American girl, forced into the mold "by the time she is going steady—at twelve," can change only by losing popularity and acclaim, and there is no popularity attached to "independence of mind, intellectual ambition, and attachment to work." Instead, there is the bitter pattern of the day: "Marry the boy right away, get the house right away, have the brood right away."

Dr. Edmund Overstreet, a gynecologist, spoke on the effects of the hormones estrogen and androgen in our bodies—the one hormone "female," the other "male," but both of them present in all of us. This all goes together. Call "analytic" thinking "masculine" (not superior, just different). With it goes intellectual creativity, figure-dependence, a little more androgen, mathematical skill, low authority-acceptance, dominance and independence. Call "global" thinking "feminine": with it go field-dependence, passivity, a little less androgen, verbal skills. All of us have a little of this, a little of that, to varying degrees.

Miss Mannes, (who is Mrs. Clarkson) put it this way:

"*Each human being, male or female is composed of both male and female components and.....the proportion of one to the other varies widely in each person.*"

★ ★ ★

THE rings of Saturn are about 45,000 miles wide, but new calculations show that they may be only eight inches thick. Previously it was believed they had a thickness of about 10 miles.

These are the findings of Drs. Allan Cook and Fred Franklin of the Smithsonian Astrophysical Observatory. They studied about 1,000 pictures of Saturn taken from a South African observatory. Their measurements showed the relationship of length to width of the rings was 356,400,000 to one, a ratio never before found in nature. As yet Drs. Cook and Franklin have no theory to explain this unusual observation.

Do you feel inferior to your automobile?
When you lose a coin in a vending machine does it drive you wild?
Do you long for a 'Nice Mama Robot'
That will take care of everything?
If you do, you had better read this article and learn. . . .

how to live with MACHINES

by Fritz Leiber

THE job setter at the auto plant explains defeatedly, "The machine has about 80 drills and 22 blocks going through. You have to watch it all the time to see everything is all right. And the machines have so many lights and switches—about 90 lights. It sure is hard on the mind."

The file clerk who isn't doing so very well in her night-school typing class learns that during the big switchover at her office they'll be bringing in such machines as an automatic calculating typewriter, a punched card to punched tape convertor, a collator, a magnetic tape producing typewriter, and a random access computer with a five-million-numeral memory.

In the home we are surrounded by TV, hi-fi, thermostatted heating and air conditioning, dishwasher, air-suspended vacuum cleaner, electric typewriter with a machinegun key for underlining, power mower (skip the garage and home workshop and laundry!), motorboat engine in attic, all the little whirring gadgets like electric razors and toothbrushes— . . . and what's that new toy of Junior's that takes three special batteries?

Almost everywhere (it seems on nervous days) between home and office and factory, a host of mechanical monsters beset us.

What's the answer to the feeling of sharp unease that sometimes grips us when we contemplate this situation?—and to the nightmare of a man pursued by murderous machines that lurks below the surface of the conscious mind? How can we reasoning, emotional animates relate happily to the impersonal mechanisms that surround us?

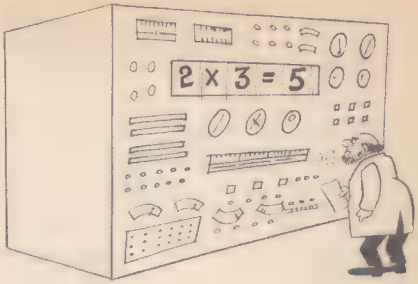
Let's turn to the experts, seeking the gist of the thoughts of industrial psychiatrists such as Dr. John McIver of U. S. Steel and Dr. Alan McLean of IBM, industrial psy-

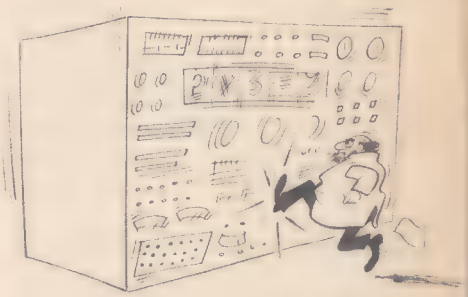
chologists like Victor H. Vroom and Norman R. F. Maier, pioneer automation mathematician Norbert Wiener, anthropologist Margaret Mead, Dr. Harry Levinson, director of the Division of Industrial Mental Health at the Menninger Foundation, and Dr. H. F. Dunbar, discoverer of accident proneness. We find emerging not so much an answer, but a series of suggestions and insights that can conveniently be arranged into a 10-point program for understanding and getting along with machines.

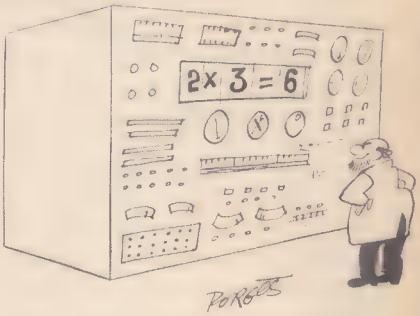
1. The machine has always been the mainstay of mankind and will continue to play an increasingly large role in our lives. Man's addiction to machinery began when the first anthropoid discovered the possibilities for increased leverage, momentum, and penetrating power presented by the bone, the stick, and the sharp-pointed stone.

And only when the anthropoid started to use tools did his brain begin to grow toward man-size. This theory is based on our knowledge of the kin of the fire-using anthropoid *Australopithecus Prometheus,* the discovery of whose remains was first reported by Prof. Raymond Dart of South Africa in 1924. For thousands of years, a cousin of Australopithecus used only one tool, the thigh bone of an antelope, yet during that period, the capacity of his skull increased measurably.

No human being need worry about his native ability to cope with machinery. It is literally built into his nervous system.







Complicated machines are not peculiar to this century. Two thousand and more years ago, the Romans used complicated artillery.

2. Machines are simple tools, non-living aids, wholly unsuitable as vehicles for emotional expression or targets for our feelings. There's

the woman who pokes nervously at the controls of a car, as if it were a bomb about to explode, and the man who dominates the road by speeding and weaving to put other drivers in their place. Both are exhibiting neurotic behavior.

Machines are our slaves or servants, and certainly not our masters. Our descendants may have to deal with machines which have developed a consciousness akin to man's, or which will at least give every outward appearance of having done so—but that is not yet our problem.

Machines running amuck?

The bugaboo of machines running amuck or of man himself turning into a machine, perhaps through the pressure of conformity, are both unreal fears, though they may give shape to real enough neuroses and even delusions. A nine-year-old boy at Bruno Bettelheim's clinic at the University of Chicago consistently acted out the fantasy that he was a machine, having to shift gears and go through the motions of "plugging himself in" before he could eat, to hold "vacuum tubes" and set up a circuit of paper strips before he could sleep, while talking in a machine language of "bam" and "putt-putt." This condition, attributed in part to an unusually unemotional, schedule-dominated upbringing, was several years yielding to loving and individualized care.

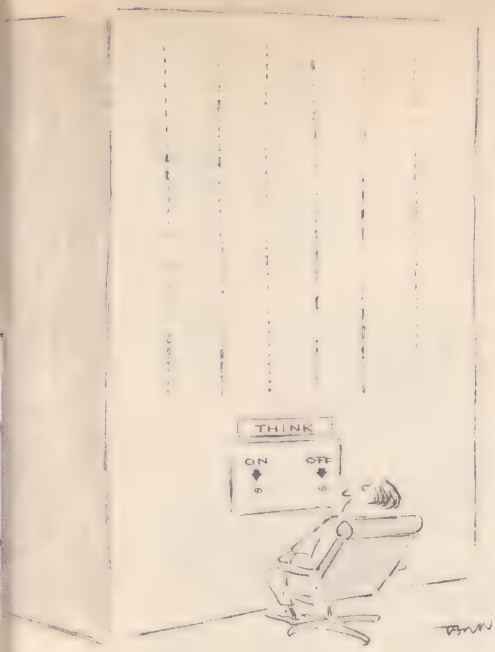
Few people's emotional problems with machines are carried to this degree, yet they show certain recurrent features:

The machine may symbolize a rigidly perfectionist authority ("You must do just so or you will be punished—I am always right"). Or it may represent a benign father-figure ("Machines will do all the work and take care of us"). It may stand for a hostile and unpredictable world. This is apt to be the case with the person, often a woman, who inwardly feels, even after studying the instructions, "I haven't the faintest idea of what will really happen if I press this button—it may just blow up."

Or a person may secretly identify with machines in order to enjoy an imagined freedom from emotion, morality, human weakness, or the need of making choices.

3. To make the best use of machines, it is necessary to do their thinking for them and do it well ahead of time. Unlike good servants or imagined robots of the future, today's machines cannot anticipate our needs and desires, so we had best always take the initiative here. Television, for instance, becomes more enjoyable and rewarding if a person studies the week's shows in advance and "programs" his TV.

A little advance thinking will prepare you, too, for the toll gates, parking-lot entrances, parking meters, subway and elevated turnstiles, fare boxes, and some of the nearly four million vending machines scattered across the United States. Here the formula for tranquil nerves is to carry an adequate supply of change.



4. Be tolerant of the primitive-number language best suited to machines. It's not their fault that they talk only in arithmetic and, in the case of advanced electronic computers, only in the binary variety: counting on one finger, not ten.

Digit-dialing of phone numbers arouses an initial resistance among many users, but the difference between dialing seven numbers and dialing two letters and five numbers is often pure illusion. The phone itself has always operated in terms of numerals alone, the dial providing a numerals-to-letters translation for the convenience of the user. Generally the conversion of a phone number to all-digits involves no change in the dialing pattern, so the user may employ his old number as a memory aid. Or if he likes to play word games, he can work out a private letter code for numbers. For instance, 6974663 translates to MY PHONE on the dial.

5. Whenever the choice is yours, select machines best suited to the human condition. Technicians in the field of human engineering have expended much time and thought in ensuring that the dials in an airplane cockpit are unambiguous and easy to read. We owe it to ourselves to do the same job for our homes and offices. A clockface or watchface with twelve evenly-spaced upright numerals is far easier to read, and so easier on the nerves, than one with some combination of Sumerian-looking wedges and Roman numerals lying on their sides.

The impact of the machine voice on human nerves should also be kept in mind. A person may find it pleasanter to awaken to the music of a pre-set radio than an alarm clock.

Also, unneeded power and speed can be as troublesome and expensive in home machines as in passenger cars.

6. Most machines are true aids, but some merely gratify the urge for conspicuous consumption to use the phrase of sociologist Thorstein Veblen. A machine, the sole function of which is to warm golf balls, is perhaps overly specialized. Along parallel lines, the economic drawbacks to the user are obvious in the case of a machine that vends five-dollar checks at fifty cents each for making purchases at the adjoining supermarket within three weeks.

7. The care of machines is the business of those wise to their com-

plex and sometimes dangerous ways. There is a great difference between replacing a worn washer in a faucet and repairing a TV set where multi-thousand volt static charges may still remain after the machine is unplugged. A person should not feel inferior at being unable to repair most modern machines.

Simpler all the time

Those dismayed at the complexity of much modern machinery can take heart from the overall principle that machines tend to become simpler as they are perfected. The reciprocating gasoline engine of the modern automobile is a vastly more complex mechanism than the battery-driven vehicle which will eventually replace it.

8. The machine provides us with the leisure and the means to increase our superiority over it. As machines replace men, some new jobs are always created, though they invariably require a higher degree of knowledge and general education on the part of the worker. Technical writing and technical editing are fields which have mushroomed.

Naturally the machine should always do away with more jobs than it creates, or it fails to justify itself. But no matter what troubles automation brings, the way out for the individual lies in his using his machine-granted leisure to acquire new skills, knowledge, and resourcefulness. To convert an office to the new accounting and secretarial machines generally takes three years, ample time for the white-collar worker to study for advancement.

9. Take regular vacations from the machine world. These may be as simple as taking a walk instead of a drive, or looking at the stars on a good night instead of TV. Sharpening a pencil with a penknife (instead of a machine) offers more interesting and tension-breaking occupation to the hands than lighting a cigarette and involves no worries about lung cancer. We are using our machines properly only when we find they provide us with more leisure time in which to be with our thoughts and with each other.

10. Seek out human contacts to replace those lost through the machine invasion. This advice comes from the writings of anthropologist Margaret Mead, who studied the easeful ways of the Samoan Islanders before World War II, as well as the more tense ways of modern civilization—including to a degree modern Samoa.

The man of yesterday going to work regularly exchanged words, and sometimes a quip or two, with individuals now often machine-replaced: newsboy, conductor, doorman, elevator operator, flower seller. His wife conversed with an attentive grocer instead of clerking for herself at a supermart.

These are very real erosions of human relationships and we must fill the gap with planned and unplanned adventurous social activities—activities that bring us, however briefly and seemingly superficially, in touch with each other.

Chicago researcher Dr. Stephen O. Schwartz has found some evidence supporting the theory that leukemia is caused by a virus.

LEUKEMIA:

key to the cancer puzzle?

by Pat McGrady

The tragic death of 13 Niles, Illinois, children from leukemia may lead medical science to a new understanding of this disease. At the moment, leukemia is still incurable —but the war against it is only just beginning.

"IN THE past six months we have had what we feel is an unusual number of deaths of children from leukemia."

This letter on the stationery of St. John Brebeuf School, Niles, Illinois, was received by Dr. John A. Rogers, until recently Executive Secretary of the American Cancer Society's Illinois Division.

The letter listed the names, ages, addresses and dates of death of eight children, and the names, ages and addresses of five more that were ill with the disease. "We hope and

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Condensed from "Leukemia: Key To The Cancer Puzzle?" Public Affairs Pamphlet No. 340. Copyright © 1963 by the Public Affairs Committee, Inc., 22 E. 38th St. New York 16, N. Y.

pray," the letter concluded, "that your efforts to cure such diseases will meet with success. May God bless you and your work." The letter was signed by Sister Mary Viva, Principal.

Sister Mary Viva's letter, dated February 23, 1961, set in motion a train of events which may lead to an understanding of leukemia and, conceivably, contribute to an understanding of the whole problem of cancer.

Today, experts are studying reported "clusters" of leukemia in such places as those shown above. In a few cases, "it seems a common denominator must exist."

The American Cancer Society, to whom leukemia is an old and familiar foe, and the Society's Illinois Division recognized in the Niles tragedies a unique and perhaps critical opportunity to study the disease at close quarters.

This was the first chance to explore an epidemic in a relatively small population; 18,863 lived in Niles, and 1,416 were enrolled in the school.

Since the inception of its all-out research program in 1946, the Society had put leukemia at the top of its public enemy list for several reasons:

(1) Of all diseases, cancer is the most frequent killer of school children; (2) of the various forms of childhood cancer, leukemia is the most common; (3) leukemia is rapidly increasing in adults; and (4) leukemia is incurable.

For other reasons, some authorities regard leukemia as the key to the control of all cancers. Its course often is so rapid that it can be followed from day to day; its characteristics are an exaggeration of the insidious start and subtle signs of many other cancers.

"White blood"

Leukemia, derived from a Greek term meaning "white blood," is cancer of the organs which manufacture blood—the lymphatic organs (the organs which manufacture lymph, the vital fluid containing blood plazma and white blood cells or lymphocytes) and tissue and the bone marrow. How it begins is a mystery. By the time the doctor diagnoses leukemia, the disease has become incurable; its genesis is impossible to trace among the myriad ordinary events, minor symptoms and small complaints of the patient.

That is why the Niles cases offered an unusual chance to study the disease.

The Illinois Division of the American Cancer Society lost no time in

TREATMENTS now available for leukemia leave much to be desired. All of them are toxic; dosages must be regulated carefully.

One estimate is that, on an average, drugs and x-rays double the brief lifespan of children ill with the disease. Whereas before 1948 one-half the children died within about four months, one-half now treated with the means commanded by medicine live more than eight months. A fortunate few live for several years.

Dozens of new drugs are in the preliminary testing stages.

Some of the most valuable and practical work in chemotherapy lies in the determination of the dose which will do the most damage to the cancers and the least to patients. Gradually the dosage schedules and the possibilities of using combinations of agents are being worked out.

Radiation remains an important treatment for many leukemics.

Fast-growing cells—normal and malignant—are highly sensitive to the destructive effect of x-rays. The big problem is how to protect the rapidly multiplying normal cells, particularly those of the bone marrow from x-ray destruction, while at the same time increasing the vulnerability of leukemic cells.

calling into the investigation the government agencies and others best qualified to sift the clues.

Dr. Michael B. Shimkin of the National Cancer Institute, himself a veteran in the experimental treatment of leukemia, called and chaired a meeting of experts on transmissible disease.

The Communicable Disease Center of the U.S. Public Health Service at Atlanta, Georgia, sent investigators.

Dr. Steven O. Schwartz of the Hektoen Institute for Medical Research was asked by the Illinois Division of the American Cancer Society to lend his highly specialized techniques to the study. Earlier he had reported that something —presumably a virus—in the brains of human leukemia victims induced the disease when injected into mice. He also had injected volunteers among prison inmates with the killed human leukemia "virus," found that they produced antibodies against the disease, and, with the antibody-loaded blood serum of the prisoners, he demonstrated that mice could be protected against leukemia.

The epidemiologists—the experts on epidemics—sought a common denominator that might explain the Niles cases.

The medical detective work showed that the Niles victims had these things in common: All thirteen children lived within a radius of two miles of the parochial school, and almost all had moved to Niles from Chicago; they either were students or they had brothers, sisters, or friends who attended the school; they came mostly from middle-class homes, and their diets, habits, sports and other characteristics

were those of the average American suburban family; they had the usual history of mumps, measles, and other childhood illnesses, and, like most youngsters, they had taken their smallpox, polio and other shots.

Nothing to set them apart

All had different doctors, and all had gone to different hospitals. Their ages ranged from three months to thirteen years. One had died in 1957; the other twelve were diagnosed or had died—and often only a few weeks separated the two events—during a seven-month period, from July, 1960 to January, 1961. There was nothing about their homes, including natural radiation from the soil and buildings, and nothing in their prenatal or short postnatal existence that would set them apart from other Niles children. Nothing, that is, except that by some secret selective process of nature these thirteen had been marked for leukemia and early death.

Dr. Schwartz is a hematologist, a blood disease doctor. He carried on where the epidemiologists left off.

In ten of thirteen families, he was permitted to take a small blood sample from each member. He tested it in three ways. In some, he found evidence of anti-virus antibodies.

This work is still in progress and tends to support the belief by many scientists that leukemia is virus-caused.

Either of two things may happen to an infected person: antibodies may form and destroy the virus, or if antibodies do not form, the disease takes its course. Dr. Schwartz found no antibodies against leukemia in any of the patients.

There are many misconceptions about leukemia. It often is considered a rare disease—exclusively a childhood disease—always speedily fatal.

The fact is that leukemia is a very common disease. The death rate is more than twice as high in adults as in youngsters. Some chronic forms of leukemia in adults run a benign and mild course for as long as ten, twenty or more years before they become acute and then, within a few weeks or months, kill the patient.

Inexplicable preferences

Leukemia, roughly, is divided into two kinds: Lymphatic (lymphogenous) and marrow (myelogenous). It assumes two phases: chronic which kills slowly or acute which kills quickly. In leukemia, immature and useless white blood cells sooner or later glut the blood stream, the marrow degenerates, and lymphatic tissues (in lymph glands, the spleen, liver, thymus, and other organs) swell with rapidly growing young cells.

The disease seems to show inexplicable preferences. White people are about 30 percent more susceptible than Negroes, and leukemic males outnumber females almost three to two. Jews have a relatively

Leukemia strikes 30 percent more

WHITES *

in the United States than

NEGROES

*Among Jews, the incidence of leukemia was recently reported to be twice as high as among Roman Catholics and Protestants.

high incidence of leukemia. In the United States, highest leukemia rates are in Massachusetts, New York, Connecticut, Wisconsin, Iowa, Missouri, South Dakota, Nebraska and Oklahoma; and they are lowest in Virginia, North Carolina, South Carolina, Mississippi, Florida, Georgia, Nevada, Utah and New Mexico.

No qualified investigator, least of all a hemotologist or virologist, would contend from present evidence that a virus is the sole cause of leukemia in humans. The evidence of other causal factors—radiation, hormones, and cancer-causing chemicals, among them—is too firmly established in both animal experiments and human studies to countenance a "leukemia virus" as the exclusive agent.

Nevertheless, a growing number of scientists are leaning to the theory that viruses may play a role in some, or possibly all, cases of leukemia-like diseases in humans. Some believe the virus may act in concert with other agents to produce the disease and to give it its presently invincible qualities.

There are two ways of looking at the present leukemia picture—with concern or with hope.

On the dark side, it must be said that the disease is as lethal as ever, although, more and more, death is being deferred a while.

On the rosier side, it appears that occasional battles are being won. At Stanford University, for instance, patients with leukemia-like Hodgkin's disease are surviving much longer and in better shape than are those given conventional treatment.

Old beliefs shaken

Perhaps the most hopeful aspect of all is emerging from the darkest area of the picture—the leukemia "clusters." "Clusters" now have been reported in such places as Chicago, Philadelphia, Cheyenne, Bergen County (N.J.) and Seattle's suburban Whidbey and Mercer Islands. Some or all of these may be a statistical mirage, a coincidental concentration of cases bound to occur in any common disease. In a few, however—such as the score or so of cases reported recently in a small community of Western Idaho —it seems a common denominator must exist. The old belief that leukemia is a lethal lottery in which victims are selected by a process as random as Russian roulette has been badly shaken.

In Niles, the genesis of the original cluster appears to have been traced to the death in 1956 of the

father of a student in the ill-starred school; and it is hoped the outbreak has ended with the death in 1962 of the mother of still another student.

The tragic circumstances of the clusters have opened a new door to the investigation of cancer. They add substance to the theoretical approach to leukemia proposed some years ago by Dr. Dameshek, the distinguished hematologist and Director of the Pratt Clinic, New England Center Hospital, Boston.

Dr. Dameshek pointed out that certain forms of leukemia are associated with the overgrowth of the cells which govern immunity. The conditions, he said, often are associated with auto-immune disturbances, in which cells become malignant and produce antibodies not against microbial predators but against the host itself. Resistance to the disease declines as the abnormal immune cells crowd the normal cells out of the system.

If Dr. Dameshek's view turns out to be correct—as the "clusters" and other evidence indicate it may be—the solution to leukemia, and perhaps to some other forms of cancer as well, may lie in maintaining or restoring normal resistance to infectious disease.

At the moment, leukemia is uncurbed and incurable.

But the war against it has only begun.

Now they say: sweets do NOT cause tooth decay

No RELATIONSHIP between the amount of sweets a child eats and the number of cavities he has was found by a nine year study by a University of Oregon dental researcher.

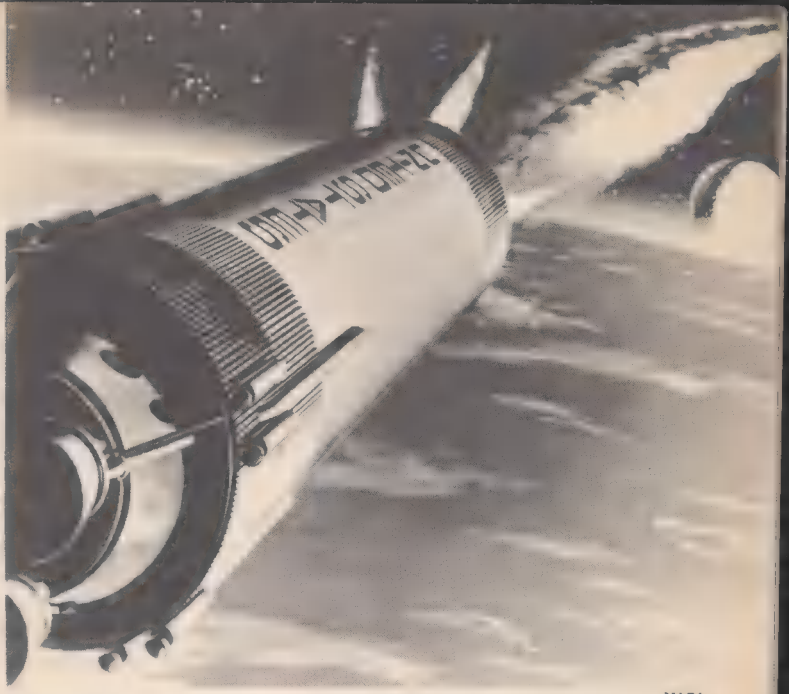
Neither between-meal snacks nor meals with high sugar content make any difference in the number of cavities, says Dr. Rosario H. Yap of Oregon's Child Study Clinic.

Investigations during the past 70 years have produced contradictory findings about the relationship between decay rates and sweet food eaten with meals or between meals, Dr. Yap points out.

In his study, 20 girls and 17 boys having reasonably good dental care but living in a community without fluoridated water, were examined twice a year. At each examination, seven-day food diaries were collected and, once a year X-rays of the teeth were taken. Examination records were started for all of the group at the age of three or earlier.

Various statistical methods for analyzing the information showed no relationship between number of cavities and sugar consumption, Dr. Yap states.

He commented that there is a characteristic peak in number of cavities at age 8 or 9 and observed that this further suggests that decay is related to some factor other than the intake of sugar. He found it was impossible to predict an increase or decrease in the number of cavities on the basis of sugar intake either with meals or between meals.



NASA

Shown here is the beginning of part two of the trip to the moon, where the booster rocket is dropped and the Apollo heads for its destination. The booster was used to put the craft in orbit around the earth.

72 HOURS TO THE MOON

A thumbnail summary telling the Why, How, and When of the greatest adventure man has ever planned.

PROJECT Apollo is the official designation of the program to put a man on the moon by 1970 at the latest and by 1968 at the very earliest. It will be a fantastically complex operation, fraught with known and unknown perils. But nobody involved in this phase of the nation's manned space flight program has the slightest doubts about its ultimate success.

Apollo will be the third major project in a step-by-step program being carefully developed by the

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National Aeronautics and Space Administration.

Project Mercury, the first phase, threw open the doors to space by proving man's capability to function effectively in the alien environment beyond our atmosphere. Mercury began with the creation of NASA in 1958.

Project Gemini will pick up where Mercury stops, with the first manned flight set for early next year. Two-man crews will begin with sub-orbital flights down the Atlantic Range and build up to missions of two weeks' duration. A Titan II rocket will serve as the two-stage launch vehicle.

Astronauts will gain practical experience in mid-space docking and rendezvous techniques with Gemini, and at times may be working outside of their vessel. They will employ a unique paraglider "wing" to maneuver their craft in landing, and will be able to set capsules down on land for the first time with a new, skid-type landing gear.

What comes first

The actual landing will be preceded by preparatory Apollo missions, including shakedown orbital flights around the earth and a trip which will circle the moon once and return.

These missions, in turn, are to be preceded by such unmanned programs as Project Ranger, Project Surveyor and Project Prospector.

Ranger aims to hard-land instruments on the moon to transmit information back to earth. The instruments will be wrapped in protective balls of balsa wood to survive the landing impact.

Surveyor will soft-land equipment to drill and analyze soil samples and televise images back here.

Prospector will soft-land a larger, more sophisticated payload—one that will be able to move about the surface of the moon.

Burn liquid hydrogen

The launch vehicle for these probes will be the Atlas-Centaur rocket, which will burn liquid hydrogen in the Centaur stage engine.

The 40-ton Apollo spacecraft will consist of three major elements. A command module will carry the crew of three along with guidance, communication and life-support systems. A service module will be equipped with special propulsion systems for mid-course maneuvering and for "deboost" into orbit around the moon and escape from lunar orbit en route home. A spider-legged lunar excursion module will ferry the spacemen down to the moon's surface and back to the "mother ship."

This is how the moon mission profile is drawn now, although NASA spokesmen caution that all plans are still wide open to change.

The three-man crew of Apollo will thunder out of earth's atmosphere atop the giant 280 foot-high Saturn V vehicle, scheduled for its first NASA launch in '65. The five-engine first stage will have a thrust

of seven and a half million pounds in hoisting a lift-off load totaling six million pounds from a new site near Canaveral. The second stage, equipped with five smaller engines, will have a million-pound thrust. Stage 3, which will push the craft into an inclined earth orbit, will have a thrust of 200,000 pounds. By contrast, the Atlas rocket used in the first U.S. orbital flight had a total thrust of only 365,000 pounds.

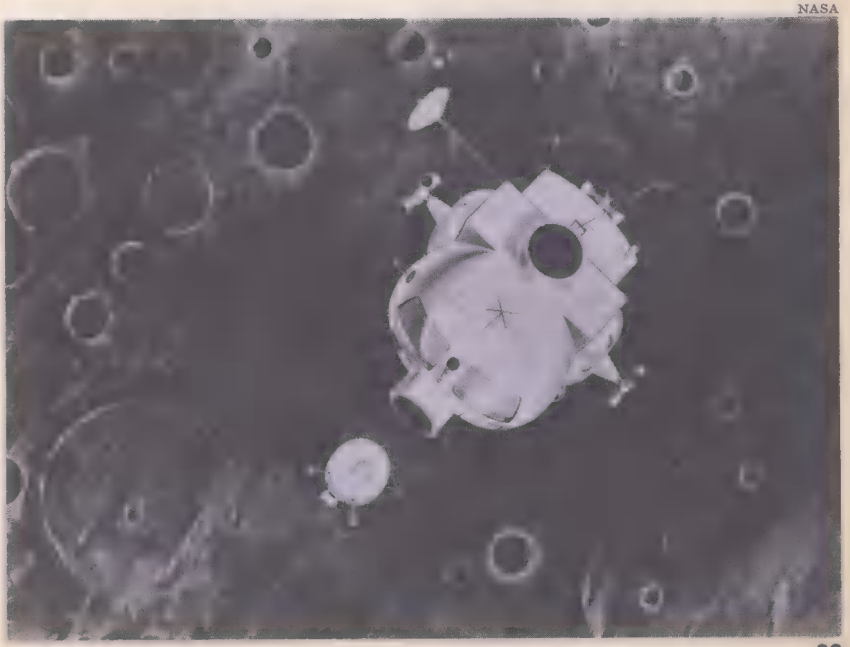
If all is working well, the vehicle will be injected into its translunar trajectory from a "parking" orbit. In the first few minutes after injection, the command and service modules will be re-oriented to mate the lunar landing vehicle with the command module in a nose-to-nose manner.

The voyage to the moon will take about 72 hours, traveling at a speed that would take the astronauts from San Francisco to New York in ten minutes.

The ship will enter a predetermined lunar orbit some 100 nautical miles above the surface of the moon. Two of the astronauts will transfer to the landing vehicle and make the descent. At an altitude of about ten miles they will hover over the surface, moving laterally if necessary, to choose the best touchdown site. Maps, reconnaissance data

The bottom part of the landing vehicle, which serves as a launch pad, is left behind on the moon, while top part of the vehicle with its two passengers heads for a rendezvous with the mother ship which is orbiting the moon with the third astronaut.

NASA



and perhaps even a beacon landed in advance will aid them in picking a suitable spot.

Only one astronaut will get out at a time, spending no more than four hours each to look around, obtain surface samples, take photographs, etc. Much of the 200 pounds of equipment brought along for exploration and experiments will be left on the moon for continued operation and transmission of data back to earth.

Time to go home

When it's time to depart, after 24 hours at the most, the crew will fire the launch engine at a precisely determined instant. The vehicle will follow an elliptical trajectory calculated to rendezvous with the command ship after traveling part of the way around the moon.

The docking of the two craft will be another critical operation. After docking, and with the three men back in the command module, the landing "bug" will be jettisoned to save weight on the return journey. The service module will be jettisoned too, just before entering the earth's atmosphere.

The 10,000-pound command module, now all that's left of the six million pounds that started the journey, will be re-oriented to enter the earth's atmosphere. It will be protected with a heat shield far stronger than that of the Mercury capsules since re-entry speed will be about 50 percent faster. A parachute will open at 50,000 feet to stabilize the craft. Then the main chute system will gently lower the ship to earth—probably on land, possibly in the area of the western plains.

In the simplified telling, Project Apollo sounds strangely uncomplicated, almost routine. But a legion of major problems will have to be solved before Apollo is undertaken. The Saturn V launch vehicle must be brought to reliable operating status. The docking and rendezvous techniques must be perfected. Specific designs for various systems and for needed hardware must be proved out. New metal alloys will have to be invented. Little problems exist, too. How will astronauts shave in flight without having their whiskers float about in the cabin because of the weightlessness?

But this is only Year 6 of the Space Age. There's no technical reason why these problems can't be cracked by Year 11 or 12 or 13. In fact, some NASA men, looking beyond the moon, are already working on rough blueprints for manned flights of a year's duration to Mars and Venus.

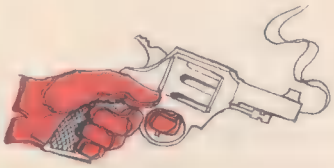
* * * *

NOVEL FOODS from wheat have been cooked up by nutritionists who are looking for new uses for the nation's mounting wheat surplus. Wheat chips, wheat toffee, wheat brittle, wheat caramel balls, and a wheat substitute for rice have been developed by food scientists at Stanford Research Institute, Menlo Park, California.

The case of the 'sudden murderers'

THE trigger for murder can be a trivial incident. But then—suddenly—an apparently normal person kills!

An analysis of 43 such "sudden murderers" has been reported by Drs. Nathan Blackman, James M. A. Weiss, and Joseph W. Lamberti in the *Archives of General Psychiatry*.



Characteristically, they say, the sudden murderer was a young man from a closely knit family in which the mother was a domineering, overprotective figure who emphasized conformity.

"Failing in his attempt to conform because of underlying feelings of inadequacy and hostility, the murderer-to-be tended to blame other people and to wander from place to place looking for greater opportunities," the doctors report. "As a result, he felt quite consciously alone and isolated from other people."

Such a person had never been involved in any previous serious aggressive antisocial acts or attempts to kill another human being. When he seemed to be getting along quite well, when society apparently expected him to be even more conforming and mature, and when he had no one to blame, he would become more and more tense and angry.

Typically, there was a period of about a month preceding the murder when the murderer seemed to make an adequate social adjustment, the doctors found. But the very effort to maintain a facade of competence and independence sapped some of the strength and weakened some of the defenses with which the killer warded off his more basic feelings of insecurity and inadequacy.

It was during this period that the murderer was "more and more preoccupied with his feelings of helplessness and the necessity to terminate his ever-increasing inner disequilibrium. . . ."

Of the 43 sudden murderers studied, 29 demonstrated this behavior pattern.

The doctors conclude, "Most such persons suffer from constant conflict between inner feelings of inadequacy and conscious needs to succeed, between an inner sense of psychological isolation and an outward drive toward conformity. Such persons maintain an extremely precarious emotional equilibrium."

The disenchantment of motherhood

Motherhood isn't all it's cracked up to be.

Half of all new mothers interviewed in a recent study suffered a "disenchantment syndrome" shortly after returning home with the child. They felt an "unexpected depression . . . a sense of being trapped within the house." And they were unhappy with the isolation brought on by fulfilling their role with the newborn child.

Here they come into emotional conflict with one of society's "demands": Mothers must always enjoy their children, and be with them constantly.

These women suffered additional feelings of guilt, so they "determinedly set about proving they were good mothers . . . and created a sort of solitary confinement for themselves," explains Dr. Sheila C. Mitchell of the Department of Obstetrics at the University of Michigan Medical Center, one of the coauthors of the study.

One hundred and forty-five couples were interviewed periodically from the seventh month of the mother's pregnancy (her first) through the second month after delivery. Dr. Mitchell found that 73 women found the period of labor was "worse" than expected. The actual delivery of the child with anesthesia was "better" than expected for 97 of the mothers.

The mothers had been married an average of 1.8 years. Their average age was 23, and the fathers' was 25. Pregnancy had been "planned" in 45 percent of the group, was "accidental" for 30 percent, and "unplanned, but hoped for, at least by the wife," in 24 percent of the couples involved in the study.

In explaining these categories, Dr. Mitchell says, "Not all women carrying 'accidental' babies were dismayed upon discovering they were pregnant, but all were truly surprised."

Driving the alcoholic to drink

The alcoholic's best friend unwittingly may be his worst enemy, says a psychiatrist from the University of Michigan Medical Center.

This paradox usually occurs when

the husband or wife of the alcoholic tries desperate measures to end the partner's drinking.

"Contrary to his conscious wish," says Dr. Robert A. Moore, "the spouse may actually act in ways which promote, rather than discourage, continued drinking."

This includes providing liquor to keep the alcoholic home for his drinking, or conversely, pouring the whiskey down the drain, so enraging him that he heads for the nearest bar.

Often the partner feels that threats of divorce or separation will force the alcoholic into treatment. Such bluffs are seldom successful, in Dr. Moore's opinion, and may make future rehabilitation more difficult.

"If the alcoholic suffers the loss of family ties, the hoped for recovery may be diminished. Faced with the breakup of his family, the victim may think the bottle is his only remaining source of gratification."

The psychiatrist says the family should assist in pointing the alcholic in the right direction toward treatment without bluffs, but with realistic concern and insistence. In some cases, aid from employers and even court action is required to provide necessary help.

Those sick, sick, sick women

A woman whose life is ruled by imaginary ailments may really be sick. Dr. Leonard L. Lovshin of the Cleveland Clinic Department of Internal Medicine says that such a woman may be an incurable "conversion hysteric."

Conversion hysteria, usually seen only in women and characterized by constant sickness, is the most difficult form of psychoneurosis to treat, Dr. Lovshin states. He also points out that little progress is being made toward curing such illnesses as conversion hysteria and hypochondria.

"Such women make poor wives and mothers," Dr. Lovshin says. They are often quite attractive and have a high incidence of divorce and remarriage.

What type of woman becomes a conversion hysteric?

"The typical picture is that of a sissy little girl, overprotected by a neurotic mother, who cannot cope with the realities of this rugged world. She builds a wall of illness to protect herself.

"These 'little girls' develop constant headaches, pains in the abdomen, backaches and a host of vague complaints and multiple aches and pains. As they get older, they usually rack up a long series of hospitalizations and surgical operations.

"These people are intelligent, sensitive and very dramatic. In fact, their whole life is an act."

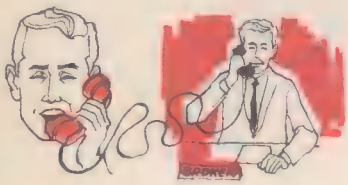
Dr. Lovshin says the disease may

be recognized and treated in teenage girls and "perhaps prevented—but one would have to remove the girl from the environment created by the neurotic mother."

Is our market "luck" psychological?

If you have been consistently losing money on the stock market, you may not need a new broker, you may need a good psychoanalyst.

Dr. Henry Krystal, an assistant professor of psychiatry at Wayne State University College of Medicine, says that the irrational stock market behavior of some of his patients is a response to unconscious drives.



Sometimes, says Dr. Krystal, stockbrokers are father-images in the unconscious mind of the customer. To the child, the father is expected to be an eternal source of infallible good advice. One man who suddenly lost faith in his broker sold all his stocks and called for psychiatric help. Some patients unconsciously want to lose their money as punishment for deep-seated guilt feelings.

Besides the more serious psychic conflicts that Dr. Krystal describes in his patients, he sees other signs that amateur investors are playing the market with childish abandon. Stock trading is often done "with the idea that you must play the market to prove you're a man," he says. "No one brags about losing a job or a business deal, but many people will freely joke about their losses in the market."

How to forget . . . and remember

Much of the time we keep a fleeting store of disposable facts streaming through our minds. We hold on to them just long enough to use, then forget them.

Typing is an example. The typist reads letters, remembers them for a brief moment while she strikes the keys, then clears them from her mind.

In an article in *New Scientist*, D. E. Broadbent from the MRC Applied Psychology Research Unit, Cambridge, England, describes how this short-term memory works.

Information is presented once and fades from the memory within a few seconds unless it can be rehearsed. Only a single rehearsal significantly lengthens the time we remember. Anything that lengthens the time between presentation and rehearsal increases forgetfulness.

By the time we hear or see a slow presentation or a long string of numbers, we forget the first parts. Even rehearsing by speaking is slower enough than mental rehearsing to let some information fade.

A Science Milestone

The Russian who talks back to Khrushchev

Sovfoto

by Albert Parry

Peter Kapitsa is the most famous scientist in the Soviet Union. Although he was kidnapped by the Russians, he went on to lead their A-bomb development and now supervises H-bomb research. But he's still a rebel.

PETER Kapitsa is a Soviet scientist (perhaps the greatest) who has no patience with Soviet dogmatism. In the last year or so, he has publicly denounced certain Soviet dogmatists for their opposition to Albert Einstein's theory of relativity and to electronic computers and cybernetics generally. He has made no secret of liking the officially tabooed work of Soviet abstractionist artists and sculptors. When one of the latter argued to Premier Khrushchev that as important a man as Kapitsa admired abstractionist art, Khrushchev retorted drily: "But this is not why we admire Kapitsa."

Peter Kapitsa is also a mystery. Not only to the West but to his fellow Russians as well. Where does he stand, what does he really believe

Copyright Cavendish Laboratory

Peter Kapitsa (second from left) at the Cavendish Laboratory at Cambridge, England. Kapitsa was the student and associate of Lord Ernest Rutherford (second from right).

in? Did he lead the Soviet Union to the development of the A-bomb, or was he arrested for refusing to work on nuclear weapons, or both?

Pyotr Leonidovich Kapitsa, born in 1894, comes of West Russian blood—from Byelorussia, or White Russia. Peter's father Leonid was a lieutenant general in the Tsar's Corps of Engineers, and some of the best private schools of Tsarist Russia gave him his initial education.

The revolution of 1917 found Peter an honor student at the age of 21 in Moscow's Polytechnic Institute. Graduating in 1918, the young man worked with Professor Abram F. Yoffe in the Physics-Technical Institute. Yoffe was Russia's earliest atomist.

But Russia's civil war interrupted his work. Amid the chaos and bloodshed of 1918-20, many scholars and their families, like millions of other Russians, were starving. Some died of hunger. Among these were Kapitsa's wife and child.

Peter himself survived but was near insanity. Crushed, brooding, he wanted to leave his homeland.

Soviet officials at first wouldn't hear of a foreign journey for Kapitsa. But Maxim Gorky, Russia's most celebrated writer and a powerful political influence as well, came to Kapitsa's rescue. In 1921, a visa was granted to Peter. Shabbily dressed, thin, thoughtful, he sailed for London.

His reputation had preceded him. British scientists knew of Peter Kapitsa as a brilliant blend of powerful analyst and practical engineer. Lord Ernest Rutherford at once

made a place for Peter in his famous Cavendish Laboratory at Cambridge.

Lord Rutherford was the genius who discovered the nucleus of the atom and was the first to change one atom into another. In his fission work he valued Kapitsa's aid from the very beginning. Kapitsa was soon recognized as the Rutherford right hand. In addition to the problem of splitting the atom, Kapitsa busied himself with the investigation of the reaction of matter to the influence of magnetic fields.

More and more the eyes of Britain's scientists were upon him. In 1929 Kapitsa was elected to the British Royal Society. Among other honors he became a full professor at Cambridge. The Royal Society built a special laboratory to suit his exacting specifications.

In his personal life he was also finding long-lacking happiness: in 1926, in London, Anna Krylova became his second wife. She was the daughter of a fellow emigré, Professor Alexei Krylov. In the early 1930s she bore Peter Kapitsa two children.

It was at this time that the Soviet government had begun a campaign of enticing gifted emigrés back to Russia. There were several notable successes: Sergei Prokofiev, the composer; Alexei Tolstoy and Ilya Ehrenburg, the writers; and—Professor Krylov, Anna Kapitsa's father.

Now for Kapitsa! Anna Kapitsa missed her father. And as her father's letters began to arrive from Russia, she found that she longed also for one more look at her homeland. Peter Kapitsa was still a Soviet citizen. He was refusing all offers of the British government to make him His Majesty's subject.

Kapitsa was a patriot of his fatherland without respect for the government that happened to be ruling it. He felt it was his duty to return to Russia someday—to give to his people the benefit of his talent and knowledge. Someday, but not too soon.

Stalin gives his word

The Kremlin was still hopeful. Would the prodigal son return just for a visit? A scientific congress was to meet in Moscow in 1934. Surely this was of interest to Kapitsa. When the congress was over he could take a vacation in the Crimea and the Caucasus. Stalin himself gave his word to let Kapitsa out once the visit was completed. Maxim Gorky backed Stalin's promise with his own guarantee. And Kapitsa believed Gorky. Reluctantly, he agreed to go. Thus in the summer of 1934, he returned to Russia.

He saw that his old homeland was immeasurably stronger and far more orderly than when he had left it. He was impressed by certain improvements introduced by the Soviets.

But though he and Anna were free in their movements, he noticed that not many Russians were. His early disapproval of things Soviet was confirmed. By the end of several weeks he dreamt of his adopted

England. Both he and Anna missed their children.

They drove north to Leningrad to supervise the loading of their luggage onto a Britain-bound steamer. It was here that the Kapitsas were told: "Your exit visas have been cancelled."

In Moscow, high officials were poker faced. Sorry, but Professor Kapitsa was a Soviet citizen and had to stay. His country needed him. Great things were in store for him. He would have everything—even his Cavendish Laboratory. Stalin ordered that, if possible, the entire laboratory in Cambridge should be purchased for him and brought to Moscow. What would the Professor say to this?

The Professor said no. The officials shrugged their shoulders. They were polite. Give him time. With the great scientist Stalin was patient.

The Professor said no. The offi- dictator. For a whole year Peter and Anna Kapitsa lived in their hotel room, hardly stirring except for a walk, demanding their right to return to England.

Lord Rutherford and other friends of Kapitsa addressed the Kremlin with protest and plea. Stalin didn't bother to reply.

To Kapitsa, Stalin sent word that he would see him if the Professor wanted to talk things over. In time Kapitsa weakened. He discovered that he longed for his work even more than for England. And so the two met, and came to an agreement.

Stalin's new promise was kept. Not sparing the expense, the Soviet government bought and brought to Moscow certain items of equipment in the Cavendish Laboratory—the items which had been used by Kapitsa for producing high magnetic fields. The British sold these in the interests of science, since no one but Kapitsa could use this equipment anyway, and since the money received for it went to buy England's first cyclotron.

In 1935 Kapitsa was made director of the Institute of Physical Problems, within the network of the Soviet Academy of Sciences. A corresponding member of the Academy since 1929, he was made a full-

Kapitsa's Accomplishments

PETER KAPITSA began his career by researching in electron inertia and properties of radioactive emission. Later he designed equipment for powerful magnetic fields and observed splitting of spectral lines in magnetic fields of 320,000 gauss (a unit used in electricity, in measuring magnetic induction or magnetic intensity, representing one line of magnetic force per square centimeter). He discovered linear increase of metal resistivity as a function of magnetic field, and studied magnetostriction of diamagnetic bodies in the fields. He invented a turbodetander—equipment for temperatures near absolute zero to be used for the production of large quantities of liquid helium and oxygen. He developed hydrodynamic theory of bearing lubrication. His scholarly publications are numerous and important. His Soviet and international honors and prizes are too numerous to be counted.

fledged member of the Academy in 1939.

On Stalin's orders, even the precise brand of Kapitsa's favorite English tobacco was imported for his pipe. The tweeds of Harris weave that he liked so well were ordered for him. And the two Kapitsa children were soon brought from England to rejoin him and Anna.

An enthusiastic, devoted circle of colleagues and students formed around him at the Institute in Moscow. His Wednesday evening "at-home" became a celebrated colloquium for years and years.

Yet, it was not atomics that held Kapitsa's primary attention once he resumed his work. From 1935 on his major achievements were in low temperatures and their application in the liquefying of air. To his credit he added the first discovery and investigation of hyperfluidity of liquid helium. His small, inexpensive turbine, used to take oxygen out of air, brought him a United States patent as well as new Kremlin honors.

In the early 1940s he returned to the atom field by helping other Soviet scientists in their nuclear researches. He built new instruments for cosmic-ray observations. During the war Kapitsa experimented with uranium and lectured on atomics in Moscow's military academies. And yet the atom didn't seem to be his chief concern.

By 1946 he had received the Order of Lenin, and there is no higher award in the Soviet scale of kudos. At this time, in 1945-46, he smilingly

Kapitsa with his pipe and imported English clothes, retained a British look long after he had returned to the Soviet Union.

denied to foreign correspondents that he was under any duress. Urbane and relaxed, puffing on his briar, he spoke in his colloquial English of all the facilities and honors he was enjoying. In his public speeches he dwelt at length on the glories of the USSR. Nevertheless, rumors spread that Stalin was not too pleased with Kapitsa.

Stalin was rewarding the atomist constantly, yes, but more in hopes of spurring Kapitsa on to atomic discoveries than in recognition of work already done. Hints were carried to Kapitsa from the Kremlin: Move "closer to actual life," that is, to the post-Hiroshima reality!

On the news of Hiroshima, Stalin tripled the salaries of his atomists.

As late as December 1945, Kapitsa blandly revealed that his most recent work had been with hydrogen. Unofficially, however, all the world knew by then that Kapitsa was leading the entire effort to produce a Soviet A-bomb.

Foreigners saw him but seldom. In the summer of 1946, to Richard E. Lauterbach, the young American journalist who questioned him about the atom bomb, Kapitsa made a wry face:

"To talk of atomic energy in terms of the atomic bomb is like talking of electricity in terms of the electric chair."

A man of peace, Kapitsa was hoping for an international agreement to outlaw the atom bomb. He hoped for mankind's survival. But, increasingly, he criticized the Americans for what he termed an unnecessary stubbornness in safeguarding our atomic secrets.

Then late in 1946, Kapitsa's name vanished from official Soviet news. He was no longer head of the Institute of Physical Problems, nor in the lists of Russian atomists awarded Stalin's prizes and medals. Complete official silence surrounded Kapitsa.

Two long years passed, and then, in 1948, an article of his appeared in a Soviet journal of experimental and theoretical physics. In February 1949, another article by Kapitsa was printed in the official annals of the Soviet Academy of Sciences. But neither was on atomics—both were on liquids.

All sorts of reports circulated then, and still abound now, about this period in Kapitsa's colorful life, but the most authentic facts seem to be these:

In Stalin's final years Kapitsa refused to contribute his genius to the evolvement or improvement of the Soviet atomic and hydrogen bombs. Stalin, not daring to shoot or even exile the great scientist, had him confined under house arrest, which may have lasted either several months or several years.

Back in the headlines

Peter Kapitsa returned to the world's headlines soon after Stalin's death. In August 1953, when Russia's possession of an H-bomb of her own became known, Kapitsa's earlier role in this achievement was generally recognized. The chairman of the United States' Joint Committee on Atomic Energy once remarked, with disquiet, on Kapitsa's "special competence in the technical problems relating to hydrogen weapons."

In 1955, two years after Stalin's death, Kapitsa was reinstated as director of the Institute of Physical Problems. Also in 1955 he made public his hypothesis about the origin of ball lightning, which in some scientific quarters is seriously considered for its potential as a military weapon of tremendous force.

It is known that currently Kapitsa supervises Soviet laboratories for development of atomic and hydrogen bombs and military use of cosmic ray energy.

And yet his rebellious voice is still raised occasionally. An outstanding recent example is his article "Theory, Experiment, Practice" published in the Moscow *Ekonomicheskaya Gazeta* on March 26, 1962. He not only attacked certain Soviet "philosophers" of the bygone Stalin times who opposed relativity and cybernetics, but also sideswiped at Trofim Lysenko, this darling of Soviet anti-geneticists, without naming him yet plainly meaning him when he wrote about "the incorrect generalizations made by our philosophers, not alone in the field of physics, but also in biology." He even hit at that sacred cow of Marxism: dialectical materialism itself!

An ordinary fiddle

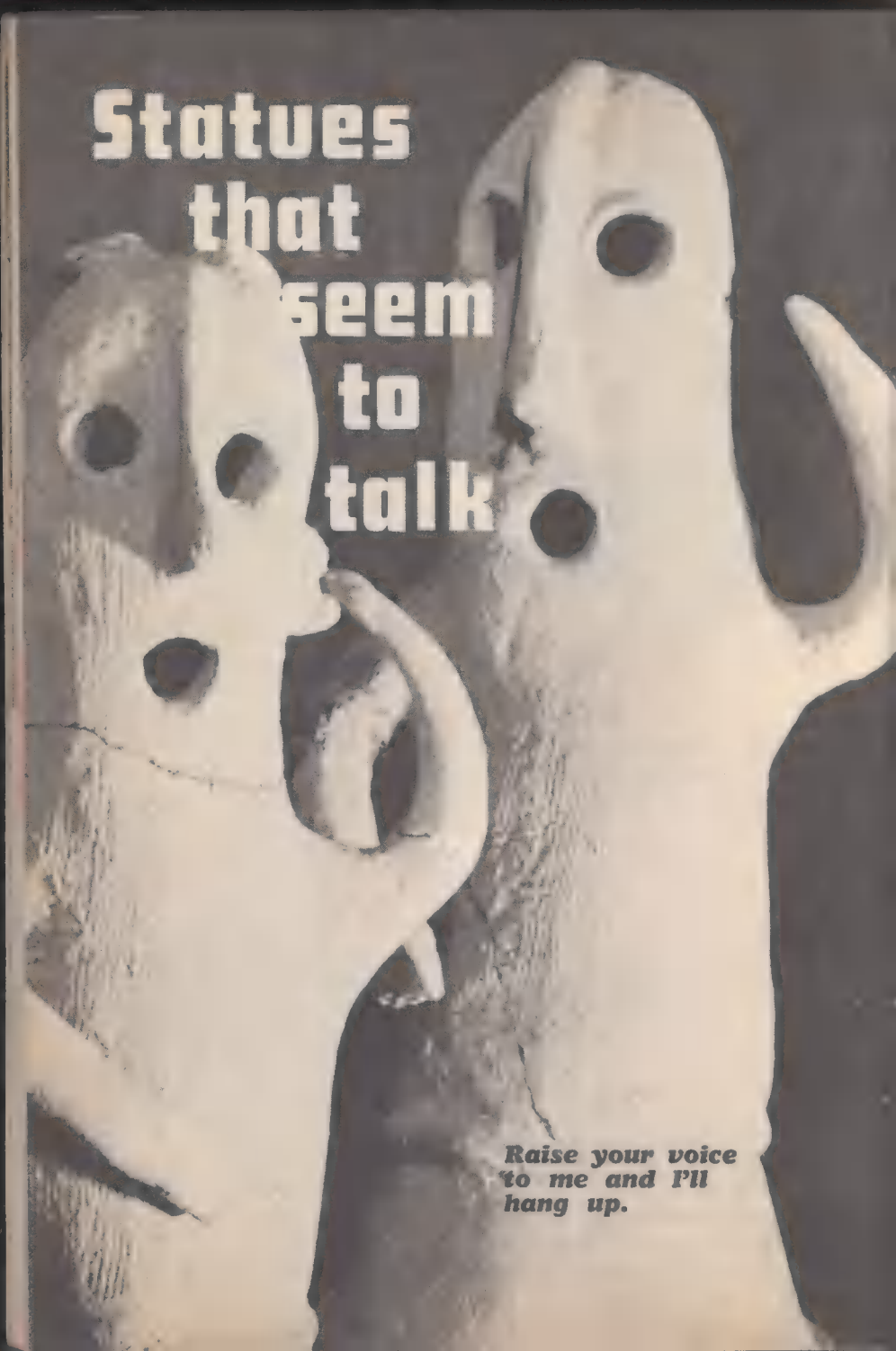
"Application of dialectics in the realm of natural sciences demands an exceptionally thorough knowledge of experimental facts and their theoretical generalization. Without this, dialectics by itself cannot solve the question. Dialectics is like a Stradivarius violin. To play this most perfect of all violins, one must be a musician and know music. Without this, it would yield false notes just as any ordinary fiddle would."

Somehow he seems to connect the dogmatists' misuse of dialectics with the fact that young Soviet physicists shun experimentation. Too little experimentation is being done in the Soviet Union these days, Professor Kapitsa asserts. In this lag he sees a danger signal for the future of Soviet science. He explains; he cites facts and figures: as editor of the journal *Eksperimental 'naya i Teoreticheskaya Fizika* he notes that, in the themes of articles submitted to him, theoretical physics outnumber experimental physics 3 and even 4 to 1. He warns: "We cannot permit any lag in experimental physics, for this would greatly hinder the normal growth of our physics—would prevent it from occupying leading positions in the world's science along the entire front of most important researches."

As he approaches the age of 70, Peter Kapitsa is still the faithful sentinel of non-Marxist science in the Soviet Union. Blue-eyed, tweedy, ever puffing on his English pipe, now mercurial and now calm, he may indeed be Peck's Bad Boy of the ever growing Soviet groves of academe.

"Don't you have a heart, Mr. Hinkley?"

Statues that seem to talk



Raise your voice to me and I'll hang up.

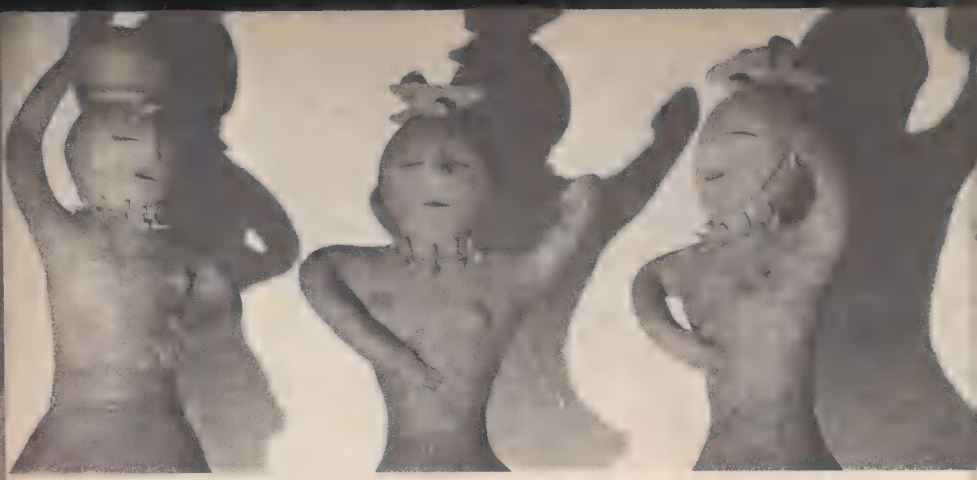
Heh, heh, heh, heh—I just look like Godfrey.

PIP pictures by ORION

Pardon me!

BEGINNING in about the first century A.D. the people of ancient Japan began placing hollow clay cylinders topped with statues around the tombs of their dead.

These statues or *haniwa* (clay cylinders) are unique because of their simplicity and humanity. They have given us a wealth of information about the people who made them.



Dig that bossa nova, baby!

The *haniwa* were set up fence fashion around the grave mound, and it seems they helped to prevent the earth of the mound from slipping. Hundreds or even thousands were used around a single mound. The figures were usually about 20 to 39 inches high.

Making the images was easy. Long strands of clay were piled in spiral coils to form the rough shape. The figures, which topped the cylinders, were then smoothed out and the clay fired for hardness.

Haniwa remained important until the seventh century when the spread of the Buddhist practice of cremation put an end to mound burials and made the clay statues unnecessary.

Haniwa sculpture depicted such objects as temples, umbrellas and weapons. All types of animals were also made out of these clay cylinders.

But most interesting of all are the *haniwa* that portray human beings.

In these deceptively crude figures, the ancient artists were able to capture the personalities of their contemporaries. They include men and women from all walks of life—dignified officials to clowns. And when you look closely at these statues you may get the feeling that they are actually talking in a casual modern lingo.

Which way to Cape Canaveral?

Nor did Alice think it so very much out of the way to hear the Rabbit say to itself, "Oh, dear! Oh dear! I shall be too late!"

—Alice's Adventures in Wonderland

Never have enough time?

by John and Molly Daugherty

ALL people have precisely the same amount of one thing: time. Each of us has 168 hours a week, no more, no less. Benjamin Franklin called time "the stuff which life is made of." How much do you understand it? Try this quiz to find out:

1. Your sense of time was fully developed when you were
   _____ a. Born
   _____ b. 14 years old
   _____ c. 21 years old

2. Your psychological time in relation to your physical time is
   _____ a. The same
   _____ b. Different
   _____ c. Always shorter

3. When you are depressed, your appreciation of the value of time
   _____ a. Increases
   _____ b. Stays the same
   _____ c. Decreases

4. If you are usually late to appointments, chances are you are
   _____ a. Getting back at an authoritarian in your past
   _____ b. Slower-moving than most people
   _____ c. Afraid to meet people

5. A disturbance of your sense of time is due to unsympathetic parents
   _____ a. Always
   _____ b. Never
   _____ c. Sometimes

6. A person who "kills time" is
   _____ a. Having fun
   _____ b. Lazy
   _____ c. Immature

7. How many time zones are there around the Earth?
   _____ a. Twenty-four
   _____ b. Two
   _____ c. Twelve

8. In a scientific theory, the steady-state theory of the universe, an attempt to probe the mysteries of time, space, and matter, time is
   _____ a. Decreasing
   _____ b. Limited (or finite)
   _____ c. Unlimited (or infinite)

(Continued on next page)

9. How many times a year are days and nights equal in time everywhere on the Earth?
   _____ a. Twice
   _____ b. Once
   _____ c. Never

10. Which of the following is now used to date back 50,000 years quite accurately?
   _____ a. Stones from the Pyramids
   _____ b. Radioactive carbon
   _____ c. Sand from the desert

Answers:

1—b Though time didn't start with you, your sense of it did! When you were a baby, you began to learn about time as the intervals between feeding lengthened.

"Were you in the Civil War?" a five-year-old child asked the school principal, a Korean War veteran.

If the child had been 14, he would not have asked. According to Dr. Gerson M. Davidson, a lecturer in psychiatry at Hunted College, New York, your sense of time is fully developed when you reach 14.

2—b It's different. Psychological time is influenced by the way you feel about things. If you're sick in bed, you spend a longer psychological time waiting for the doctor than he spends getting there, though the physical time is the same. Your teen-age daughter sitting in a parked car with her boy friend thinks time is shorter than you do, waiting for her to come in, though the physical time for both of you is the same.

3—c Dr. Erwin W. Straus of the Veterans Administration Hospital in Lexington, Kentucky, made a study of the effect of the time sense in depressive states. He says patients think that "since things have been so bad in the past and the road to the future is blocked, there's no reason to do anything in the present."

Neurotics block themselves by rejecting time, by believing they'd start living NOW if they had more money or they'd do a better job NOW if they could ever get a break. They try to escape the present by denying it, or by using sleep, daydreams, fantasies, drugs or alcohol to avoid the reality of time.

4—a Your inner clock may be the result of a long-delayed reaction against your parents. Dr. Franklin DuBois of the Silver Hill Foundation for the treatment of psychoneurosis in New Canaan, Connecticut, made a study of time in relation to psychiatric illness. He says when you waste time you're rebelling against an authoritarian figure in your past.

5—c Sometimes, but not always. According to Dr. DuBois, organic reactions such as alcohol, high fever, head injuries, mental deficiencies, senile dementia, cerebral arteriosclerosis and electric shock cause partial or total loss of the sense of time.

In Dickens's *Tale of Two Cities*, Lucie's father, Dr. Manette, had a confused sense of time because of his 18 years in prison.

6—c Dr. C. P. Oberndorf, who did research on the relation of time to reality and purpose, said, "The mature adult does not 'kill time,' because he has a purpose . . . that initiates action to make life significant in terms of service to others."

7—a The earth rotates 360 degrees in 24 hours. Every 15 degrees of longitude, approximately, there's a different time zone. At the International Date Line in the Pacific, at sunrise, each new day dawns for the earth.

8—c According to the steady state theory, advanced by astrophysicist Dr. Fred Hoyle and others, the universe, which maintains its general cosmological structure through the continuous creation of matter, will present the same aspect to observers at the same moment of time.

9—a At the Equinox periods, March 21st and September 21st. At that time, the sun is directly overhead at the equator.

10—b If an object contains carbon, scientists can determine its age by the radioactivity of its carbon. They can measure time quite accurately without referring to historical events, according to Professors Wendell H. Slabaugh of Oregon State College and Alfred Butler of the State College of Washington. Archaeologists, for instance, estimate wood from an Egyptian tomb to be 4,600 years old, and the radioactivity of the carbon in the wood shows it to be 4,500 years old.

Scoring your answers

9-10 right: Apparently you know that time is infinitely more than the tick of a clock.

4-8 right: You probably go along with Goethe, who said, "We always have time enough if we will but use it aright."

0-3 right: You may be no Einstein, but you probably understand enough about time to know what he meant when he said, "When you sit with a nice girl for two hours, you think it's only a minute, but when you sit on a hot stove for a minute, you think it's two hours."

NERVES KILL the Norway lemming, not starvation or mass suicide or migration. So concludes Kai Curry-Lindahl, who followed the 1960 lemming explosion in Norway and Sweden.

He noticed that the small rodents became tense, with vicious tempers and high screams. Only pregnant females remained calm.

In September, the population suddenly plummeted. Curry-Lindahl suggests in the *Journal of Mammology* that stress changed the lemmings' hormone balance, resulting in fatal physiological changes. Apparently two billion is company, three billion is a crowd.

The new, exciting world of Psychical Research

Author J. D. West with objects captured from a fraudulent medium.

Do you believe in ESP? The question is academic to researchers in extrasensory perception, according to a newly published paperbound book, *Psychical Research Today* (Penguin Books, 85¢). The author, D. J. West, an officer of Britain's Society of Psychical Research, says that most students of the subject appear to accept ESP.

"It is amazing that the research has gone as far as it has. For the most part the work has been done by a handful of investigators, isolated from normal university life, hedged in on the one hand by cranks and miracle-mongers, and on the other by the disdain of a prejudiced orthodoxy."

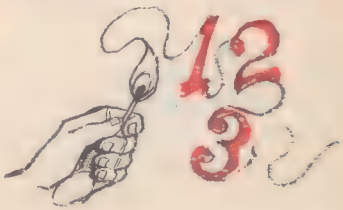
In his book, West debunks mediums: "Although they frequently lay claim to being engaged in scientific activities, they have never contributed to any new discoveries." But he carefully sifts through scientific experiments in ESP.

He especially concentrates on one aspect: precognition. All kinds of physical theories have been advanced, he says, to explain telepathy, in which people share a mental image, while apart, at the same instant. "The stumbling block to all theories," West adds, is the experience of people who see future events. Here, the answers may be metaphysical. West quotes one researcher as suggesting that "in our consciousness the present moment has a definite, if small, duration of time . . . the 'specious present.' All events within this span of time are perceived as happening simultaneously. But at subconscious levels of the mind, the duration of the specious present might be much longer, in which case events perceived as 'present' in the subconscious might to the conscious be in the future."

Research to find the answers, West says, "carries on slowly, much of it done by devoted amateurs in their spare time, but as experimental methods become more complex and exacting, it becomes increasingly difficult for trained experimenters to give the necessary time to it when they are otherwise busily engaged in a competitive world. This is the dilemma of psychical research."—*H.P.*

Here are two quick ways to look like a mathematical wizard.

Fool your friends with— NUMBERS TRICKS



Numbers from ashes

THIS is a spectacular trick in which you burn the paper on which a calculation has been done, and then produce the answer from the ashes by rubbing the ashes on your arm. Have yourself blindfolded, and give the person who will do the calculation these directions: "Write down a three-digit number so that the first and last digits differ by more than 1. Now reverse the digits. If the result is a larger number, put it on top. If the result is a smaller number, put it below. Subtract. Now reverse the digits in the answer, and add. Fold the paper twice so that the answer is hidden."

After you remove the blindfold, place the paper on a metal tray and set it on fire with a match. After it burns up completely, wait a few seconds to allow the ashes to cool. Then say, "The answer *was* on the paper. Now it is in the ashes, so I shall have to get it from the ashes." Then roll up your sleeve, and rub the ashes over your arm. Like magic, the answer will appear in broad black numbers on your arm.

The secret of this trick is that, when the directions are followed, the answer always comes out 1,089. So, before you do the trick, and while no one in your audience is looking, write the number 1,089 on your arm with the edge of a wet piece of soap. The writing will dry quickly, and will be invisible. When you rub the ashes over your arm, some of it will stick to the soap film on your arm and make the numbers visible.

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Guessing someone's birthday

To guess somebody's birthday, tell him, first, to keep in mind two numbers: the number of the month in which he was born, and the number of the day of the month on which he was born. The months are numbered in the usual way, from 1 to 12, beginning with January. Then give him these directions: "Multiply the number of the month in which you were born by 5. Add 6. Multiply by 4. Add 9. Multiply by 5. Add the number of the day on which you were born." Give him time to finish all the calculations and when he finishes, ask for the final result.

Now you silently subtract 165 from the result. After you subtract, the last two digits tell you the day, and the other digits tell you the month of the birthday. For example, if his result is 989, when you subtract 165 you get 824. So you know he was born on the 24th day of the 8th month, that is, on August 24th.

This trick is based on the fact that our numbers are written in the ten-scale. The directions you give to the person are a disguised way of adding 165, the day number, and one hundred times the month number. When you subtract 165, the day number and one hundred times the month number are left. Because the month number was multiplied by 100, it appears as the number of hundreds, so you find it to the left of the figures that represent the day number.

"I don't believe in the curse, but maybe we should knock first?"

the progress of MEDICINE

New heart attack facts

A group of California physicians have used radioactive beads in animals to determine how rapidly new blood vessel formation occurs after a coronary attack to bring blood to the heart. They found that three weeks after the attack 30 per cent of the larger beads could get through the new blood vessels. Six to eight weeks after the attack, nearly all the larger beads passed through. The researchers said that based on their findings the activity of a heart patient should be held to a minimum six or eight weeks after a heart attack instead of the three weeks recommended by some physicians.

Why people smoke

SMOKERS have particular body builds, an anthropologist finds. They are taller and heavier than non-smokers. They have larger head, face, shoulder, chest, hip, leg and hand dimensions. The difference in physique raises the question of whether genetic or biological make-up plays a role in the smoking habit, says Dr. Carl C. Seltzer, a Harvard research fellow in anthropology.

If it is true, as some contend, that disease can be related to body build, then scientists must consider the possibility of a constitutional factor in lung cancer, Seltzer writes in the *Journal of the American Medical Association*. The same innate or host factors that contribute to the smoking habit may predispose to lung cancer, he suggests.

"There is no evidence as yet that this is so," he says, "but it is important that we shed some light on this problem, one way or another."

Seltzer obtained measurements from the routine medical examinations given in 1942 to 1,138 Harvard students. A questionnaire on smoking habits was sent to each in

1959. None was told the reason for the questions. Replies were received from 922, or 81 percent. Among the current smokers, the average smoking history was 14 years. Among those who had discontinued, the average was 11. The median age was 35, but Matthews emphasized that the physical measurements were taken in the college years when body build was not changed by habit, diet, physical activity, health or disease.

In each of 10 measurements, the smokers had greater dimensions. In mean weight, the "pure" cigar smokers were 10.4 pounds heavier than non-smokers; the pipe smokers, 6.6 pounds; and the cigarette smokers, 4.3 pounds. There was no gradation computed in physical characteristics based on the number of cigarettes smoked.

Matthews said it is becoming increasingly clear that smoking or abstention are not simply due to environmental influences. On the contrary, he adds, smoking behavior appears to be a response to a wide variety of personality and behavioral characteristics which have their origin, in part, in the biological or genetic makeup of the individual.

Victory for blood pressure drugs

Since 1950, the death rate from diseases of the heart and blood vessels has gone down 6 percent among middle-aged men. Dr. James V. Warren, president of the American Heart Association, called this drop the first relatively sustained improvement seen in the cardiovascular mortality picture.

The 6 percent drop is primarily due to decreases in the death rates from cerebrovascular diseases and high blood pressure, Dr. Warren says. For many years, the death rate from cardiovascular disease among middle-aged men had been creeping upward in the United States, in contrast to a steadily declining rate among women in the same age bracket.

During the last 13 years modern drug therapy, particularly for hypertension, has saved persons who used to die in a year or two from rapidly progressing malignant hypertension. Such persons are now able to lead active, productive lives for 5, 10 or more years, Dr. Warren points out.

Pity the itchy

The itching patient is a person with seriously compromised civil rights, contends Dr. Farrington Daniels, Jr., of Cornell University Medical College. He is sick and he is miserable but instead of the sympathy to which the sick are entitled, he is treated by society with hilarity or disgust.

If you have a broken rib or

pleurisy, you don't have people in the hospital shouting at you to breathe evenly, Dr. Daniels points out, but if you are beside yourself with generalized itching, you can count on nurses and doctors shouting at you not to scratch. Itch is a symptom generally confined to the skin surface, Dr. Daniels adds, but this does not mean it can be cured with various "goops" applied to the skin surface.

Colds from air pollution?

Strong circumstantial evidence has been accumulating that acute upper respiratory diseases, including the common cold, occur more frequently in places where there is a relatively high concentration of sulphur compounds, the U.S. Public Health Service says. Sulphur dioxide and other sulphur-containing gases result from burning of coal and fuel oil in industries and homes.

At the PHS sanitary engineering center in Cincinnati, various laboratory animals, including ferrets and monkeys, will be exposed to sulphurous gases of the type released into the atmosphere by industrial cities. The animals then will be exposed to viruses known to cause the common cold in human beings to see whether pre-exposure to the sulphur gases triggers a more severe infection.

New hearts for old within 25 years

In 25 years, there will be successful transplantation of vital organs including the heart, from one person to another to replace diseased or worn-out organs.

Blood clots which now produce heart attacks will one day be rendered harmless by injecting enzymes which will dissolve the clots.

Heart-lung machines will be developed to take over the patient's circulation, not for hours as at present, but for days, to help not only in the treatment of heart defects but also of cancer and other diseases.

These are predictions of three Yale University surgeons, Dr. William W. L. Glenn, Dr. Horace C. Stansel, and Dr. Michael Hume.

Cancer viruses may lie dormant

Some laboratory animals contain viruses which are harmless unless "triggered" by an agent such as radiation. When this happens they multiply rapidly and cause the development of leukemia and other tumors.

Dr. Ludwik Gross of the cancer research unit, Veterans Administration Hospital, Bronx, N.Y., says the triggering agent may also be a hor-

monal imbalance within the body.

Should these experimental observations be applicable to humans, it would follow that individuals suffering from leukemia represent only a small fraction of those actually carrying the seeds of this disease. In his laboratory work, Dr. Gross found that leukemia viruses presumably exist in many normal mice without causing disease. They are transmitted naturally from one generation to another directly through the embryos. Under certain conditions, the leukemic virus may also be present in the milk of leukemic female mice, and infect their offspring.

Needed—'adults only' vaccines

Getting successful vaccines against viral respiratory infections depends on learning what viruses are causing how much of what illnesses, says Dr. Maurice R. Hilleman, director of virus and tissue culture research, Merck Institute for Therapeutic Research.

It may be found, for example, that different vaccines will be required for adults and children. He cites a study conducted among 667 children and 155 adults showing that 11 particular viruses accounted for about 40 percent of the children's illnesses but only 19 percent of the adults' ailments. The leading offender in the children's illness was the respiratory syncytial virus but in the case of adults, the blame was distributed evenly among the influenza and para-influenza viruses, the adenovirus and the coryzavirus.

Dr. Johnny can't write

Illegible writing by doctors and nurses is costing hospitals thousands of dollars in deciphering time, says

Dr. Herman Feldman, research director of Methodist Hospital, Gary, Ind. He set up a scaling system for measuring legibility of orders written at the hospital and tested samples on nurses, ward secretaries, licensed practical nurses and others who read orders daily.

About 120,000 orders are written annually in the hospital. He computed that if all these were judged legible, it would take 3,200 hours a year to interpret them at a minimum cost of $6,000. But if all were judged illegible, on the basis of the scaling system, it would take 30,000 hours and cost $54,000 a year.

Forty percent of all orders written were less legible than the average, Dr. Feldman found. At an average cost of 30 cents for each order, it cost the hospital $12,000 more in money and 6,400 extra hours.

New mapper of the deep

TAKE her up, motions Dr. John S. Reitzel, chief scientist on the first scientific cruise of *Atlantis II* (above), new research vessel of the Woods Hole Oceanographic Institution, Woods Hole, Mass.

The device being hauled back on board is a "pinger," which is attached to the cable about 75 meters above instruments used to study the ocean floor. It makes a steady clicking sound, whose echo enables scientists to tell how deep the ocean is at that point.

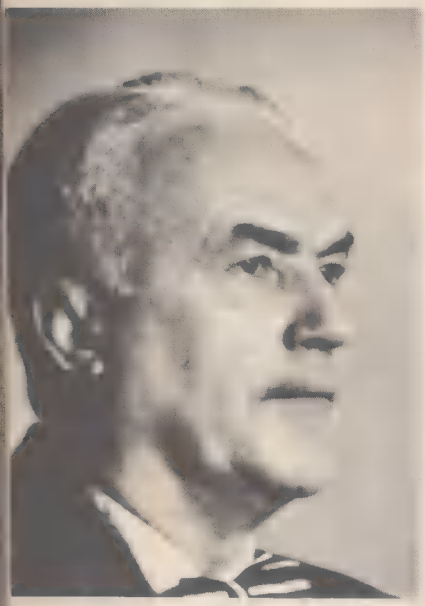
The pinger is just one of the many scientific instruments aboard *Atlantis II,* which has been described as the most carefully designed and best equipped oceanographic vessel ever built.

The ship is 210 feet long, 44 feet wide, has a cruising speed of 12 knots, a range of 8,000 miles and accommodations for a scientific party of 25 and a crew of 28.

The new vessel was launched earlier this year, and one of its first tasks was an unhappy one—*Atlantis II* aided in the search for the wreckage of the sunken nuclear submarine *Thresher.*

Wiltshire Boulevard to Broadway in 60 minutes

by Walt Boyne



Engineer Nathan Price

TODAY a jet can whisk you from Los Angeles to New York in 5 hours. But it takes at least 45 minutes on each end to travel to and from the airport, and another hour waiting to get on and off the plane. Total time 7 hours and 30 minutes.

By 1975 supersonic airplanes promise to cross the continent in an hour and a half—but the two-and-one-half hour ground time will remain the same. Total time: 4 hours. A 400 percent increase in the speed of the plane will cut the total time of the trip by less than 50 percent.

One proposed solution to this dilemma is the ASTRA system, the product of 14 years of operations research by California engineer Nathan Price. Price, an established consulting engineer, and once flight engineer on Howard Hughes' private plane, is the holder of many basic patents on pressure cabins and jet propulsion devices. His concept embraces every aspect of the modern air transport problem, from the choice of aircraft to baggage loading.

ASTRA (Air Space Transportation) is figuratively a subway in the sky. Vertically rising passenger missiles are regularly shot out of the guidance center on predetermined courses. Vertiports, located in the middle of cities will house the missiles, their controllers, the maintenance shops and the passenger facilities. Traffic, be it inter-urban or inter-continental, will be computer controlled. A passenger will be able to go from Wiltshire Boulevard in downtown Los Angeles to Broadway in New York City with greater ease than he can now travel from Pasadena to Santa Monica. The total trip will take about 60 minutes.

As Price sees it, a passenger will take his baggage to the ticket counter in the Los Angeles vertiport a few minutes before flight

time. After paying his fare, he steps on an endless belt which carries him to the proper missile aisle. His ticket and baggage are electronically programmed into the proper channels. The ASTRA missile loads quickly, passengers entering the wide clam shell doors while their baggage is stored from below.

Thirty seconds before take-off time the doors close and the missile moves toward the departure ramp. Twelve booster jets roar into action lifting the missile vertically. In two minutes, the missile attains cruising speed and switches to ram-jet propulsion. As the big ram jet opens up, the boosters shut down. A speed of 2,890 m.p.h. and an altitude of 100,000 feet are achieved after acceleration.

A gentle deceleration causes the passenger to look up from his magazine to the television receiver mounted overhead. He can now pick out the skyscrapers of Manhattan. The ASTRA homes for the New York Vertiport guided by heat-seeking and infra-red systems. Sixty minutes after takeoff, the traveler steps down from the missile to the belt which will deposit him, bag and baggage, in downtown New York.

The ASTRA missile is a com-

Artist's conception of the Los Angeles ASTRA Vertiport. Passenger missiles could enter and depart through subwaylike tunnels. Tunnel entrances and exits could be located in parks or suburban areas to reduce noise and traffic problems.

paratively simple device — finless, wingless, and without conventional landing gear. Its most compelling argument is its vertical rising feature, which cuts hours from the ground time, makes short hauls economically feasible, reduces the noise problem, and provides a high degree of safety.

The 72-foot-long structure has a semi-circular cross section tapered at the front and slightly flattened at the rear. The 64 passengers are seated 8 abreast, four on each side of the narrow aisle. Because of the short flight time there will be no need for a galley or extensive toilet facilities. For the same reason, flight crews and cabin attendants can be kept to a minimum.

Waiting, waiting, waiting

Anyone who has run from a taxi to the line at the ticket counter, watched the time drain away as the ticket clerk laboriously scratches out hieroglyphics on the ticket, and then raced down seemingly miles of halls to some remote gate, knows that improvement is needed in the ticketing system. Anyone who has waited in a stack over a weather bound city, circling idly while his connection departs, knows that improvement is needed in the traffic system.

ASTRA offers improvements in both areas. The vertiport integrates all the ground phases of airline operation within a single structure. A vertiport capable of handling all air traffic, passenger and cargo, for the city of New York, could be built in a space measuring 500 feet wide, 300 feet long, and 160 feet high, Price estimates. It would fit nicely into the top ten stories of a skyscraper, or, using the opposite approach, could be built underground, with subwaylike approach and departure tunnels. Tunnel entrances and exits could be in parks, railroad yards, suburban areas, etc., and would further reduce traffic and noise problems.

Arriving ASTRAs home into an arrival tunnel or an arrival ramp on one end of the structure, while departing ASTRAs leave from a tunnel on the opposite end.

Price envisions a system of multiple cable driven tracks which will haul the missiles to the passengers. Refueling takes place on the five minute trip from the unloading area to the loading area. Maintenance and inspection of the missiles is done on the floors below. Any malfunctions picked up by the ground monitoring system will have been pinpointed, and a substitute missile made ready for the next leg of the flight.

From lift off to touchdown, the Astra will be guided by signals from the ground. In the event of a complete automatic equipment failure, the pilot will have the necessary basic instruments and controls for a safe emergency landing.

Price visualizes starting initially with mail and cargo carrying ASTRAs, and then working year by year into a complete national, then international, ASTRA network.

YOUR SCIENCE ABC's

The fascinating world of science is closed off to many of us because we have forgotten or don't know the ABC's of science. Science Digest here presents the second part of a regular, simply written series on the basics of science.

Buoyancy

How heavy objects float

You will have noticed that if you hold a stone under water, it appears to be lighter than when in air. You may even have tried to force an auto tire filled with air under water, and noticed how it forces itself upwards. We call this upward force "buoyancy," and it is this which enables a ship to float.

A stone takes up a certain amount of space, called its volume, and if we put it into a water jar, the water is pushed away to make room for it. The water pushed aside, or displaced, as we say, has the same volume as the stone. Where does this displaced water go? It causes a rise in the water level. This gives us a way of measuring the space, or volume of any object heavier than water, for if we put it into a jar marked so as to measure volume, then, if the object is entirely under water, the rise in water level tells us its volume.

Suppose we have a piece of metal in the shape of a cube with each of its sides one centimeter long; then its volume is one cubic centimeter. If this is put under water then the amount of water pushed aside is one cubic centimeter. Now, one cubic centimeter of water weighs one gram, a very useful fact in the metric system, and so any stone with a volume of 100 cubic centimeters loses a weight of 100 grams while under water.

Destroyers made of heavy steel float because they are largely filled with air, and they sink to a level such that the weight of water pushed aside, or displaced, is the same as the weight of the vessel. Putting this another way, we can say that the upward force of flotation of the water is the same as the weight of the ship.

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Cells

The units of life

In biology, cells are the tiny "building bricks" of which all living matter is made. Our own bodies are built up of many millions of millions of cells, of a great number of different kinds. For example, we have brain cells, nerve cells, muscle cells and skin cells.

Every creature begins life as a single egg cell. The cell grows very slightly and then splits in half, forming two cells; then these split into four, and so on until there are several millions of them. As they keep dividing they change in shape and arrange themselves to form the tissues of a body. Each cell carries "instructions" as to what it is to do in a small dark spot in its center. This is called the "nucleus," and within it are a number of tiny threads called "chromosomes." The "instructions" are in the form of complex chemical substances arranged along the chromosomes in a row; they are called "genes." When a cell divides to form two, all the chromosomes split lengthwise so that each daughter-cell gets its proper share of genes. One gene may cause the growing body to have blue eyes, another sees to it that it will have exactly five toes, and so on. All the different species of plants and animals have different numbers of chromosomes, which carry their own special genes.

Cells are the "building bricks" of living things. The center or nucleus of a cell contains thread-like chromosomes within which are the "instructions" for heredity.

Chemistry

The science of elements and compounds

This is the science that seeks to find out what substances are made of, and to understand how their ingredients are put together. All substances belong to one of the following classes: (1) elements, (2) compounds, (3) mixtures. The elements are simple substances that are not made of anything but themselves. Iron is an example, for there is nothing whatever in a piece of pure iron but—pure iron. Other familiar examples are copper, carbon, gold, iodine and oxygen.

About 93 different kinds of elements are found in nature, and the smallest imaginable particle of any of them is called an atom. Most of the elements are metals, but some, like sulfur and phosphorus, are

non-metals. With very few exceptions they all have solid, liquid and gaseous states, according to their temperature. Thus, iron is a liquid at 2,700°F., and a gas at 5.000°F. Oxygen is a gas at ordinary temperatures, but becomes a liquid when cooled to —300°F. A few elements, like iodine, pass directly from the solid to the gaseous state without melting when heated.

Compounds are substances composed of two or more different elements. They are not, however, just mixed together; each atom of one element is linked tightly to one or more atoms of the other elements, so as to form a new kind of substance. Water is a good example, for it consists of two atoms of hydrogen linked to one of oxygen (H_2O), and has properties quite unlike these two gases. The smallest particle of a compound is called a molecule, and it always contains its different atoms in exactly the same proportions.

A very great number of compounds are known, two very important groups of them being known as acids and alkalies. Acids and alkalies have a strong chemical attraction for one another, and any acid will combine with any alkali to produce a "salt." For example, common salt is produced when hydrochloric acid is mixed with the alkali called caustic soda. Hydrochloric acid and caustic soda are both dangerous poisons, yet common salt is both wholesome and necessary for life.

Mixtures are simply elements or compounds, or both, mixed together in any proportions. They possess all the properties of their ingredients and can generally be separated again by quite simple means. Mud is a mixture of earth and water, and air is a mixture of nitrogen and oxygen. Mixtures are not new kinds of substances.

When elements combine together to form compounds they either give up or absorb energy. This is generally in the form of heat. When coal burns, the carbon in it combines with the oxygen in the air to form carbon dioxide, and it gives off the heat which you can feel. But when carbon (by a roundabout process) is made to combine with hydrogen to form acetylene, it absorbs heat instead of giving it out.

Substances which will combine together to form new substances are said to have "chemical affinity" for one another, and their combination is called a "chemical reaction." Chemical reactions also occur when they break up, for some compounds are not very stable and separate into their constituents again very easily. This is what happens when dynamite or T.N.T. explodes.

The study of chemistry is commonly divided into two sections. The study of the elements and those compounds that are not made exclusively by living creatures or plants is called "inorganic" chemistry. The study of the much more complex substances produced by living bodies is called "organic" chemistry.

Some of the molecules in organic

substances contain thousands of atoms, but this is possible only because of the peculiar properties of the carbon atom. Carbon atoms can join together to form rings and long chains, on to which the atoms of other elements can be "hooked." Nearly all the materials of living bodies therefore contain carbon, so that organic chemistry is sometimes called the chemistry of the carbon compounds.

This is a very difficult study, as you may imagine if you compare the formula of a simple inorganic substance like water, H_2O or sulfuric acid, $H_2\ SO_4$, with that of an organic substance like hemoglobin, which is the red coloring matter in your blood. Its formula is $(C_{759}\ H_{1208}\ N_{210}\ S_2\ FeO_{204})_4$. Important groups of organic substances include the carbohydrates (sugar, starch, cellulose, etc.), the alcohols, organic acids, fats and proteins.

Computers

Counting with electrons

Devices and machines for helping with arithmetic have been in use for thousands of years.

The electronic age has given birth to a new kind of calculating machine—the electronic computer.

Actually, there are two types of electronic computers. All the largest calculators are "digital computers." If you have ever had an opportunity to look inside a desk adding machine, you may have noticed that it contains many toothed gears. Desk adding machines work by counting gear teeth; for instance, when you push the button for "3," a gear turns three teeth, and when you then add 5 by pushing "5," the gear turns five teeth more, or eight in all, and an "8" is printed on a piece of paper. Electronic digital computers work in the same way, except that they count short pulses of electricity instead of gear teeth, and work so fast that a human cannot push the buttons for them; instead, a punched tape or some equivalent tells the machine what to do.

The other type of electronic calculator is the "analog computer." Analog machines use electric currents of varying voltage instead of pulses of electricity to perform calculations. The idea behind the analog computer is subtle, but not really hard to grasp. In doing arithmetic, we are accustomed to using numbers, but we could use physical quantities instead. Thus, 3 and 2 can be added by drawing a line 3 inches long on a piece of paper and then extending it 2 inches, and reading off the result: 5 inches. In the analog computer, varying electric currents are utilized as we have just utilized lines on a piece of paper. Analog computers are not nearly as accurate as digital computers, but there are some kinds of problems—particularly having to do with missiles and satellites—that they solve very efficiently.

Many can carry out tens of millions of long multiplications an hour. This has made it possible for scientists to carry out in a few hours calculations that would otherwise take months or even years. In addition, digital computers are very efficient in performing all sorts of business tasks, from counting stocks of merchandise to preparing pay checks, from keeping accounts to registering telephone calls and preparing telephone bills. Further, computers have been adapted to running factory machines. Many petroleum refineries are already run by computing machines. In Cleveland, an automobile engine factory turns out a completed engine every two and a half minutes, untouched by human hands. The drills, lathes and other machine tools that shape the rough metal and assemble hundreds of parts into an engine are controlled by punched tapes prepared by computer equipment. The process of operating machines under the control of automatic machines is called automation.

Cryogenics

The world of supercold

Since heat is molecular motion, absolute zero means the complete absence of heat.

The world of absolute zero is a strange world and has led to a fascinating new science, "cryogenics,"

At extremely low temperatures materials act differently. At the temperature at which air becomes liquid a rubber ball becomes so hard and brittle it will shatter.

the study of supercold. For several decades, research scientists have been striving to produce cold as close to absolute zero as possible. The record is within one-tenth of a degree of the absolute zero mark, and temperatures of only one or two degrees above absolute zero are now produced quite easily by special refrigeration machines called cryostats.

At these temperatures, all known substances become solid except the light gas helium.

At temperatures near absolute zero, copper, lead and other metals lose all resistance to electric current. A current started in a ring of metal will continue to circulate indefinitely even after the battery or other source that supplied the current is switched off. Recently, one group of scientists found a way to use superconducting metals to make very powerful electromagnets that will require no electric power, except the power to start them up and the power to drive refrigeration machinery to keep them cold enough to stay in the superconducting state.

Big job for little men

Jockey James Testa's size (he weighs 95 pounds) allows him to get into tight spots.

Testa, who is five feet tall, stands alongside fellow workman Gene Carney, 6 ft., 3 in.

WHAT do jockeys do when the racing season is over?

Five of them who ride the New England thoroughbred racing circuit were hired by General Dynamics Electric Boat in Groton, Conn., to work in the tiny spaces aboard Polaris missile-firing submarines.

Their fellow workmen agree that for their ability to work in tight quarters, the jockeys are worth their weight in gold.

One department foreman says: "They're some of the best men I've got. They work hard and are stronger than most bigger men."

Four of the five jockeys have gone back to racing for the season, but one, John Vitelli, has given up the saddle for submarine construction work, although he sometimes rides night races.

The jocks were popular especially among racing fans, but they inevitably encounter some who greet them this way:

"I know you. You owe me a lot of money."

INVENTIONS PATENTS PROCESSES

Submarines, beware

A remote-controlled anti-submarine aircraft known as DASH has been successfully tested at sea by the U.S. Navy. A drone helicopter, produced by the Gyrodyne Co. of America, DASH carries two torpedoes and is designed to be used by destroyers to extend their range of attack against submarines.

When a submarine is detected, the craft is flown by remote control to the area, drops its torpedoes and is then recovered by the destroyer.

The helicopter's flight is controlled from two points aboard the destroyer: on the flight deck, and in the Combat Information Center. The take-off, the flight toward the target, and landings, are controlled from the flight deck.

How to date a rock

TELLING the age of rocks is now a simple matter. A new technique enables you to see "fossil" records in rocks by means of a bottle of acid and a microscope.

The technique has been outlined by two General Electric Research Laboratory scientists. Drs. P. Buford Price and Robert M. Walker found that particle tracks were produced in minerals by uranium atoms when they underwent natural fission. Drs. Price and Walker discovered the particle tracks in a sample of mica, a mineral found in rocks throughout the world.

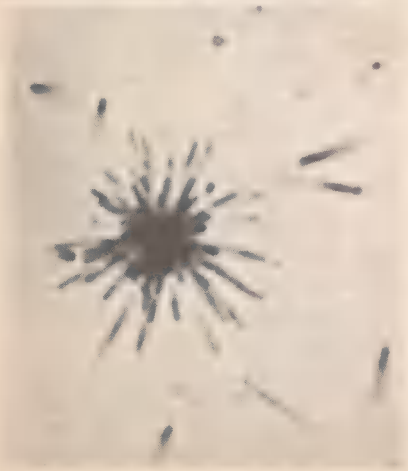
The principle behind the method is this: the atoms of a radioactive element decay at a known rate into atoms of elements that are not radioactive. Some uranium atoms decay by undergoing fission, splitting spontaneously into two fragments of about equal size. As these fission fragments move apart in a piece of mica, they leave a trail of damage. The damaged region, about .0005 inch long by a few atoms in diameter, makes up a permanent "fossil" record.

It is possible to enlarge these tracks by dipping the sample of mica into hydrofluoric acid. The

acid etches out the damaged regions as well as some of the surrounding material, making the tracks visible through even a low-power optical microscope.

Actually gauging the age of the rock takes more complex equipment. After the mica sample has been etched, the tracks are counted. Then the total amount of uranium in the sample must be determined by irradiating the sample in a nuclear reactor, artificially splitting some of the remaining uranium atoms. After the sample has been etched a second time, a count is made of the fresh tracks produced by artificial fission. The age of the sample can be calculated from the ratio of old tracks to fresh tracks.

Counting "fossil" particle tracks produced by uranium atoms provides a new method of dating rocks. This close-up, magnified 5,000 times, shows a burst of "fossil" tracks radiating from the splitting of uranium atoms in a sample of mica.



This tire, ten feet tall and almost four feet wide, is described as the world's largest by its manufacturer, the Goodyear Tire & Rubber Co., Akron, Ohio. Workers load the first of two tires being shipped for use on an oil-well drilling rig in Africa. Two of the tires are enough to fill a regular tractor-trailer.

Islands under the sea

An undersea island designed to house a naval base for submarines or an off-shore oil drilling rig, has been patented by engineer R. Buckminster Fuller. Fuller is known for his geodesic domes, pillarless structures made of a lacework of triangles, diamonds, and hexagons. He calls his newest design a "Submarisle."

It is a buoyant steel caisson held in place by lines that run to several anchors distributed around it. Access for men and materials is provided by elevator through a hollow vertical shaft leading to a boarding platform above the surface. The anchor lines, made of Dacron or steel are especially designed to

keep the island from rotating, at the same time allowing up-and-down movement with the motion of the tide.

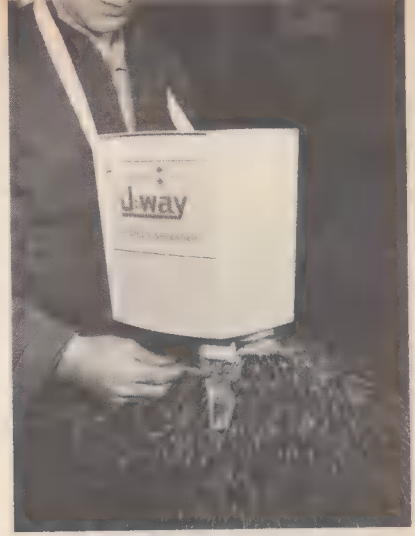
When used for drilling, the island is expected to escape most of the buffeting by wind and sea which is inflicted on platforms built on pilings. Oil can be stored in the island's tanks when it is too rough to remove it.

When intended to serve as a submerged base, the island will have a slip for berthing submarines and an access hatch.

The inventor feels that it can be used as a manned base for exploration of the ocean floor. He envisions a series of the islands, installed one above the other, for operations at greater depths.

This lawn spreader is portable

A line of products for home gardeners, that can be dispensed through a portable rotary spreader has been announced by S. C. Johnson & Son, Inc., Racine, Wis. The lawn spreader, introduced as a new method of feeding and caring for lawns, weighs 11½ pounds loaded and can be slung around the neck. By turning the crank at the bottom of the plastic spreader, the wearer can distribute fertilizer and other lawn products over a six-foot-wide path.



A lawn gardener can distribute fertilizer and other lawn products over a six-foot-wide path by turning the crank at the bottom of the "J-Way" spreader.

Specially designed for use with the "J-Way" spreader are a fertilizer, a combination fertilizer and weed killer, and a pre-emergent crabgrass preventer, all pelletized. According to the company, the rotary spreader will cover an average lawn of 5,000 square feet in only 20 minutes.

The company also offers a pressurized weed killer that can be fired from a standing position and a pressurized rose and flower spray that can be sprayed while the can is held upside down, making it easier to reach the underside of leaves.

For that sudden shower

Now you can get low-cost plastic rain capes, based on the same principle as the plastic rain bonnets which snap back into their permanent folds with a pull. They are available from Instant-Fold Products,

Low-cost plastic rain capes are five feet square, yet they fold back to compact size for easy carrying.

Inc., One Park Avenue, New York, N.Y. They come in both poncho and wrap-around style and are 5 feet square, yet fold easily to their original compact size. A plastic carrying pouch comes with the capes.

science toys

Grow your own shrimp

A series of 10 low-cost Science Discoveries Lab Kits have been introduced by Pickett & Eckel, Inc., 109 South Fremont Ave., Alhambra, Calif. The kits offered are: Electromagnetic Force, Growing Crystals, Solar Spectrum Lab, Rocks of the Earth Lab, Relative Humidity Lab, Magnetism Lab, Chemistry of Matter, Measuring Heat Energy, Germinating Seeds Lab, and Growing Shrimp Lab, which contains about 5,000 brine shimp eggs and instructions on how to hatch them. Each kit contains experiments explained in step-by-step style.

Space-age Erector set

For the first time in 50 years, the Erector set produced by the A. C. Gilbert Co., New Haven, Conn., has a brand new look. New multi-colored solid metal panels, pre-programmed motors, modernized girders, and other new components give an old favorite space-age modernity.

Erector set's new look adds realistic touch to the model of a planetary probe these two boys are building.

My friends—the rats

by Frederic W. Nordsiek

White rats are not at all like those dirty, vicious animals you occasionally find in alleys and cellars. They are clean, gentle, extremely useful, and to some even lovable.

LIKE most people, I had always thought of rats as wild, dirty, vicious little animals. So that morning when the white rat dealer brought me a wooden crate emitting chirping, chuckling sounds, I opened the box with sinking heart. Probably the animals would come tumbling out, scatter in all directions and be lost. Or else, if I grabbed them, they'd attack.

But when I had pried off the lid, all I could see was one motionless ball of snow-white fur in a corner of the crate. Looking closer, I could see a few bright, cherry-red eyes peering at me from various parts of the furry heap. White rats are great believers in "togetherness."

Still it was with much misgiving that I reached into the warm furry heap and hesitantly withdrew one member of it. I found in my hand a silky soft creature a couple of inches

long and weighing a little over an ounce, with snow white coat, pink paws, tail, ears and snout, glistening red eyes, and long snowy whiskers which twitched engagingly as it sniffed me. From time to time it tasted my fingers with gentle nips that hurt not at all.

Like all albinos, white rats have poor eyesight. They rely mainly on hearing, smell, touch, even taste to explore their environment.

This first encounter with white rats occurred back when I began my research for my doctor's degree. I had to get to know white rats the hard way. I was the first Ph.D. candidate in a brand new department, which had not yet set up its laboratories. So when I had found a place to work, obtained cages and other needed equipment, I had to order some newly weaned baby rats and begin without either guidance or experience in how to handle the tiny beasts.

Because of their natural gregariousness, rats living in groups thrive better than when kept separately. They even eat more, because competition to get at the food hopper seems to sharpen their appetites. A cage full of rats butting and shouldering to get at their feed is a miniature of rush hour riders trying to get into a subway train.

Frederic W. Nordsiek, biologist, nutritionist, and public health authority, is a graduate of the Massachusetts Institute of Technology. He obtained his M.S. in biology from New York University and his Ph.D. (nutrition) from Columbia University.

But for some types of research, such as my own nutrition studies, animals must be kept separately in individual cages. Such rats thrive only if they get frequent attention from their human keeper, as a substitute for lacking association with their own kind. Although thus tending my rats takes up much time, I enjoy it tremendously. The animals are usually all asleep when I enter the cage room, for white rats keep the nocturnal ways of their wild ancestors, and if left alone sleep all day. As soon as I approach, though, they arouse themselves, yawn (with much waggling of tiny pink tongues), stretch and await their turn for attention. Then I proceed to pick up one animal at a time, inspect it to check on its health and the progress of the experiment, and finally pet it, play with it a bit and put it back in its cage.

Scientists have found that rats which are petted regularly by human handlers—even for just a few minutes each day—grow faster, assimilate their food better, are more active and curious, learn more rapidly, resist poisons better, and are less harmed by physical or emotional stress. One huge laboratory—where there are so many rats that the individual scientists cannot care for their own animals—employs a full time man called a "gentler." He does nothing all day long but take each rat out of its cage in turn, pet it, and put it back.

The size of white rats is ideal for laboratory uses. They don't take

up much room, but yet are not too small for convenience in handling. Also rats are inexpensive to buy and to feed, and respond just like human beings in many experiments.

A rat lives about thirty times faster than a man, though, so that experimental results are ready that much sooner. Studies that would take thirty years if done directly on the human can be done in about a year on the rat.

Baby rats double their birth weight during their first six days of life. A human baby takes six months to do the same. Female rats have their menopause at the age of eighteen months. A three year old rat is as rare as a ninety year old man; unless specially protected, rats die, usually of pneumonia, before three years of age. But studies of rats two to three years old have told much about what aging does to the animal body, knowledge that is being directly and usefully applied to human beings.

You can see the speed at which rats live by watching a rat mother, which is a study in accelerated, miniaturized maternity. Young rats pass through adolescence about two months after they are born, and are ready for full family responsibilities at an age of three months. Twenty-two days after she is mated, a mother rat gives birth to from one to seventeen babies, usually about ten. Then she makes a crude nest from the torn papers or wood shavings maternity cages are provided with.

Nursery in the ventilator

This instinctive maternity behavior of pregnant rats once had a nearly disastrous effect on one of my studies. I used to use paper tags on my rat cages to mark them, and to jot down observations. One morning I found to my horror that most of the tags had been ripped off, and that the pieces were nowhere to be seen. Unless the tags could be found, the whole experiment would have to be repeated.

Then during a quiet moment when I was at work in the rat room later that day, I heard the faint but unmistakable squeaks of a litter of newborn rats somewhere overhead. I found that an escaped pregnant female rat had set up her nursery on top of a ventilator duct up near the ceiling. Lacking the nest material she had collected her own during the night by tearing the paper tags off the cages.

Back around 1800 or even earlier, white rats were kept as household pets. Today they are to be found mainly in laboratories. There now are millions of lab rats all over the world.

Bred for docility

The albino rat's whiteness is quite irrelevant to its value in the laboratory. Captured wild rats are useless not because they are gray, but because they are much too highly strung and ferocious. Today's white rats have been bred and selected for docility for over a century. During this long association with mankind, they have changed in appearance as well as in demeanor. Their jaw muscles have weakened, and their snouts have become correspondingly narrower. Thus today's laboratory white rats look no more like their wild forebears than modern man resembles his caveman ancestors.

White rats cannot bite as viciously as can wild rats. But if they are hurt or frightened, they nevertheless can and do stick up for themselves valiantly. In daily handling of large numbers of rats, however, I have never once been badly bitten or scratched. One needs simply to handle the animals in a calm and assured manner, and always to be gentle. As one scientist puts it, "Gain a rat's confidence and it will cooperate with you; but don't take advantage, or it will draw blood!"

Given a choice of foods, rats instinctively select a well balanced diet. They also have an uncanny ability to recognize and avoid foods that contain harmful materials. White rats can also be taught a variety of things by their human masters. They can learn to solve mazes and puzzles. As a result, these creatures are immensely useful to psychologists in studies of how learning happens, and in other psychological research as well. Rats can be made neurotic by repeated frustration, and have been valuable in experimental studies of how frustrations may affect us.

Another very important reason why white rats are useful in research is that they are all the same as identical twins, because they have always been "inbred" by matings of brother and sister. That is why they look as alike as so many peas in a pod, and respond alike to any experiment. But although they are all thus identical in looks and function, in personality they are as different as so many people. That is why I always gave my rats

names instead of numbering them.

Let me tell about a rat named Roberto, whose dedication to freedom came near to ruining one of my experiments.

At one time I repeatedly found cage doors open and rats at large every morning. Fortunately it never was any trouble to round the animals up, and as each is marked with indelible dye to identify it, I could put each back into its proper cage.

Always Roberto!

At first I accused myself of absentmindedness, and became obsessive about returning to the rat room several times each afternoon to make sure I had latched all the cages. But the escapes continued.

Then, belatedly, I did a little thinking. Which rats did I find loose? Sometimes just Roberto, sometimes Roberto and one or two others. But always Roberto! A nocturnal vigil in the rat room seemed necessary.

The next evening I rigged a dim light near the cages, set a comfortable chair where I had a clear view, and settled down to watch. As the day waned, the animals began to wake up; the animals started to eat, drink, groom themselves, and move about the cages.

I watched Roberto's cage most closely. Soon I saw him shoulder his feed cup forward until it was near the door of the cage. He climbed up on the cup and, after much fumbling, got one forepaw through an opening near the latch. Then, after a good deal of random pawing, one stroke of his paw happened to strike the latch and lift it. As Roberto was leaning against the door at this moment, out he tumbled. Restraining my combination of amusement and annoyance, I managed to remain motionless.

Roberto crawled about for awhile sniffing with great curiosity his widened environment. Once he returned to his cage to eat and drink. Then his seemingly random movements brought him near another cage, where he began to paw the door. After a bit, one stroke of his paw opened the latch of that cage, and out came the tenant.

From that time on none of my rats enjoyed an occasional night of freedom.

* * * *

The fiction of drinking

ARE WE drinking more? Such a notion is fiction, not fact. According to *New Medical Materia,* the number of references to alcohol per 100 pages of text in best-selling novels between 1900 and 1904 was 4.0. Between 1946 and 1950, the number of references had jumped to 5.9. By contrast, the annual per capital alcohol consumption by members of the drinking population of the United States between 1900 and 1904 was 2.39 gallons per capita. During 1946 to 1950, this consumption diminished to 2.06 gallons.

BOOM TIME

Boom time is noon time, the hour when the magnifying glass on this nineteenth century alarm sundial focuses sunlight in the touch-hole of the toy cannon. Enough heat is generated to ignite gunpowder in the cannon, and announce the noon hour with a bang.

Over the centuries sundials have been built in many forms—columns, hemispheres, cones and steps. In a new book, *Sundials*, (The Macmillan Co., New York City. 126 pp. $3.50), astronomer Roy K. Marshall explains the theory of sundials and traces their history from the Babylonians. Sticky-fingered Roman armies snatched up many sundials in their forays through the Near East. They shipped them home to use as municipal bric-a-brac, but didn't know what they were for or how they worked. Had they known they would only have been confused, because a sundial made for Alexandria gives the wrong time in Rome. Finally, 450 years after capturing their first sundial, the Romans built one of their own.

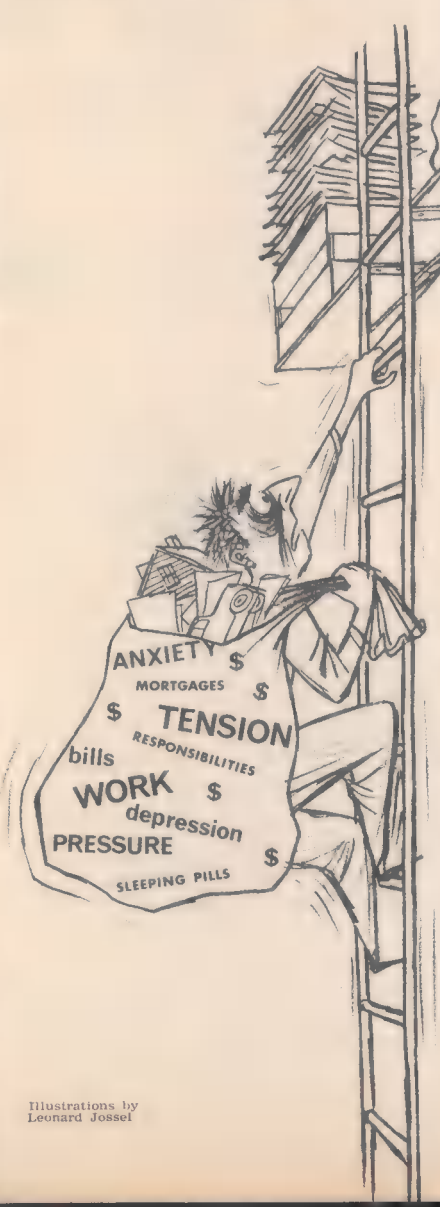
It wasn't until about 900 A. D. that the Arabs developed trigonometry and put the design of sundials on a firm theoretical foundation. This broke the secrets of the trade and made the use of sundials widespread. They became a time standard for sand, water, fire and the then inaccurate mechanical clocks.

In 1379, Henry de Wieck built one of the first tower clocks with an escapement. Although it was so much more accurate than earlier clocks that people suspected a man hid in the tower to turn the hands, it lost or gained up to two hours a day.

By 1581 enough was known about sundials to fill an 800-page book. But all anyone today needs to know is in Mr. Marshall's slender volume.

—*B.H.F.*

In America today, we can rise from rags to riches—and this makes us nervous. We know more about what's going on in the world—giving us more to worry about. We can analyze our psyches—but psychology just makes us feel worse. We have got real troubles.



Illustrations by Leonard Jossel

Are you tense? here's why

ARE YOU a part of a large group, who live intimately with either a knot in the guts, a touchy temper, a vague depression or an inability to sleep?

This is tension or anxiety—a nagging, nameless fear of unknown and intangible dangers. It's not necessarily severe enough to put you out

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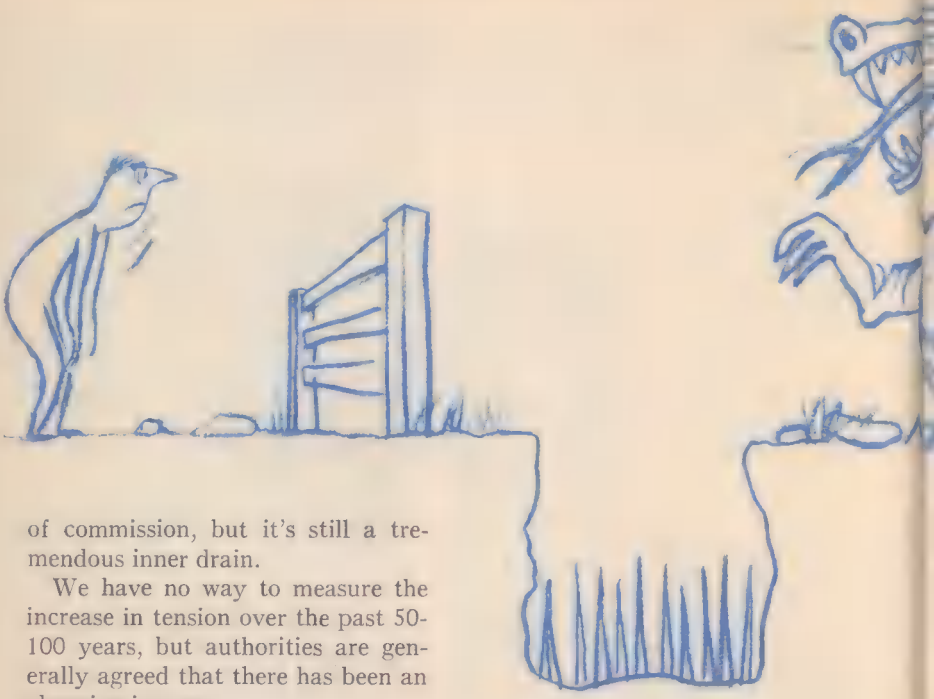


of commission, but it's still a tremendous inner drain.

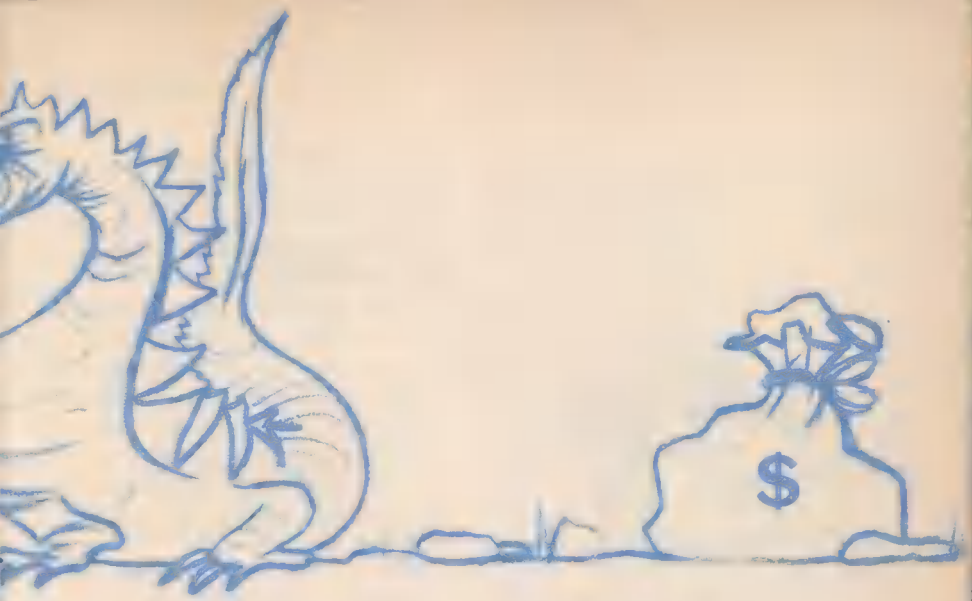
We have no way to measure the increase in tension over the past 50-100 years, but authorities are generally agreed that there has been an alarming increase.

Of the 175,000 residents of a midtown Manhattan neighborhood sampled by the Social Psychiatry Department of Cornell Medical College, 82 percent showed symptoms of mental disturbances ranging from mild to severe. Only 18 percent were found to be completely free of any emotional disturbances.

This is not just a big city problem. Two rural studies—one in Nova Scotia and one in Nigeria—conducted by Cornell Medical College, revealed the same general mental health pattern with the same degree of prevalence and the same range of symptoms found in the so-called "Midtown Study."

Sleeping pill and tranquilizer sales are in themselves a significant indicator. One out of every 12 adults, according to a *Chemical and Engineering News* survey, takes tranquilizers regularly. The pills, which came on the market only in 1956, are now the third largest-selling prescription drug. Retail sales in 1961 hit $200 million, and wholesale sales to hospitals, $25 million. The sale of anti-depressants, on the other hand, totaled $32 million. What's the reason for this nationwide attack of the jitters?

The breakdown of economic and social lines goes deep into the heart of the matter. The concept that a man is free to be and do anything he wants, if only he will push hard



enough, is loaded with emotional dynamite.

Seventy-five years ago, a shoemaker's son growing up in his family's home on Elm Street, could see the outlines of his life. He, his sons and probably their sons would be shoemakers and live in similar houses on similar streets.

Today, the system is infinitely more volatile. In all likelihood, that same boy thinks that if he hustles hard enough, someday he may head an international shoe concern and live in a penthouse in Manhattan. The world is within his grasp. It's all up to him.

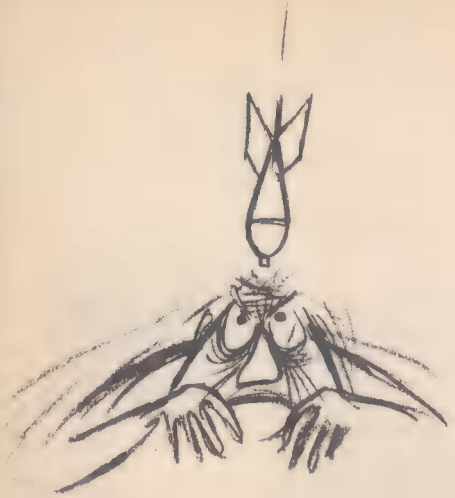
Herein lies an intolerable burden, one that leads men to strive beyond their limitations.

Dr. Charles Flory of Rohrer, Hibler & Replogle, psychological consultants, says: "This man is only able to hold on to his job by working too hard and too long." Dr. Flory suggests that a more realistic reappraisal of himself and his job is in order.

The business situations that offer the most freedom to move up contain the most anxieties. Military and civil service careers and even those in some well regulated giant corporations are relatively calm compared to those in the advertising or entertainment industries.

In a mental health study conducted in New Haven, Conn., Yale professors August Hollingshead and Fredrick Redlich divided the population into five social-economic classes. In studying those in the upward mobile group who are severely impaired, they found that the men who have been successful in their climb seem, on the surface, to be well integrated. However, as soon as their mobility drive is blocked, they manifest deep anxieties and depression.

The "strainers"—those who aren't climbing as successfully as they



want to—resort to a Walter Mitty type of dreaming. Typically, they rush from one "big deal" to another, are inevitably frustrated and wind up blaming it on bad luck. These "strainers" are uncertain of their values and particularly susceptible to mental disorder. In their attempt to reach their goals, they are usually very hard on others as well as themselves.

On the move

The geographic mobility of our era corresponds to the economic mobility. According to the 1960 census, 75 million Americans changed homes during the past five years. Of these, 27.7 million moved to a different county and 14.1 million to a different state. Job improvement—part of the new career pattern of large corporations—was reported as the prime motive in moving.

This uprooting weakens the influence of peripheral family relationships (grandparents, aunts and uncles) as well as that of church and community. It takes a very strong family unit to withstand the emotional dislocation that results from physical dislocation.

The swift pace of technological advances has also left its mark on the national nervous system. The threat of nuclear destruction—the granddaddy of all threats—is so basically involved with the climate of our times that its individual effect cannot even be measured.

More tangible is the speed of jet travel and the instantaneous transmission of communications which makes tensions all over the world—from a famine in Laos to an uprising in Katanga—just that much more immediate.

Many people's lives are further complicated by the distractions that dance across their television screens. Fifty years ago, to a family in rural Kansas, a water ski tournament in Palm Beach or an opening night in Manhattan were remote events, far from their lives. Today, that same family can sit in their living room and see what they're missing.

Fifty years ago, too, we were not pulled in 100 different directions by the entreaties of 100 different copywriters as we are today, until we don't know what it is we have to be. Most of us end up in a continual round of frustration, trying to be everything and succeeding only in losing ourselves.

Although this tension cuts across all educational, economic, social, sex and age lines (it shows today even among a class of high school

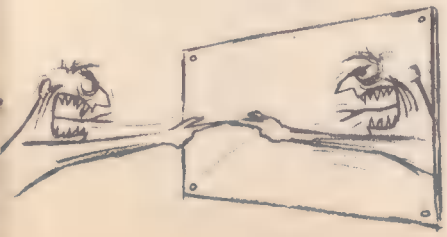
seniors worrying about college entrance), it hits different groups differently.

Psychologists and sociologists have established that each social economic group exhibits a different pattern of mental illness. In the lower classes, there is a much higher incidence of severe impairment—psychotics and schizophrenics. The higher groups are marked by a preponderance of such minor neurotic traits as compulsion, aggression, "free-floating" anxieties, chronic worry and hypochondria.

Bachelors in trouble

Married women, the researchers notice, complain of more symptoms than their husbands do, but actually have about the same degree of mental health. Though a woman is more vulnerable to marital discord, since this is usually her whole life, her husband has the additional burden of business pressures.

The Midtown Study did establish that unmarried women are less neurotic than unmarried men. The impairment rate of bachelors is more than twice that of spinsters. The researchers feel that bachelors are either the self chosen (or confirmed) type, which in itself implies a deviation from the norm, or they think of themselves as rejected.



On the other hand, spinsters who have not received an acceptable proposal, think of themselves as unchosen, which is not as hurting as rejection. Furthermore, as compared to rejected bachelors, within the group of unchosen women there are women of special strength, which makes them less susceptible to mental impairment even though it may be the very reason why they were left on the shelf.

The highest degree of impairment in all marital categories are the divorced of both sexes. Ninety-six percent of the divorced men and ninety-three percent of all divorced women show symptoms ranging from mild to severe.

The unhappy years

As for age, the Midtown Study found the optimal group was 20-29 with a progressive slippage through the years. A person predisposed to mental illness often feels the most strain during two periods: first, when he has to assume the responsibilities of parenthood, and later, when the children leave home creating a domestic vacuum.

The relationship of tension to business is one of the old chicken-and-egg variety. Does the job make the man tense or would his inner tensions drive him regardless of the job? A 1958 Life Extension Foundation study concluded that tension

is not caused by job demands but stems from within the personality of the individual.

Michael Stanley, a psychiatrist who took part in the Midtown Study, feels that it's a little of both. A man starts climbing, he feels, because of his innate personality—this is the determinant in whether or not he makes money—but once he starts moving, further pressures are exerted externally.

Enough or too much?

A certain amount of tension, of course, is not only desirable, it is requisite for progress and serves as a measure of a man's concern with his work. Too much tension, however, interferes with his decision making and his ability to handle people.

One factor that confuses the measurement of tensions today is our greatly increased psychological awareness. (This itself causes anxiety—we worry about the fact that we are worrying too much). Fifty years ago, a man would blow his top at his secretary and write it off as bad temper. Today, he's aware that it's an indication of tension and starts analyzing the blow-up.

Psychological patter dominates books, theater, dinner parties to the point where it has become a cliche. Perhaps our grandfathers were under more strain than they were aware of; or perhaps we have more awareness than is always warranted.

Americans have some homegrown problems that the rest of the world is not as subject to. For one thing, American culture is based on change. All change, psychologists says, is threat, and threat produces anxiety. Someone is always switching the ground rules for everything from child-rearing to dietary habits. Confusingly enough, theories, concepts and attitudes are often "out" as soon as they're "in."

We are also brought up expecting life to be happy all the time and get, perhaps, unduly upset when it isn't. Other peoples of the world have a more realistic and accepting attitude towards their lives—they do not expect it to be a bowl of cherries.

Take what small comfort you can from the knowledge that the next wise guy who asks, "Are you some kind of nut or something?" probably is *some* kind of nut himself.

"Careful Smythe, it may be a trick."

Science in the news

About June 25, we may learn important facts about the planet that has most fascinated man since he first started studying the sky. That's when Russia's so-called automatic interplanetary station is scheduled to pass by Mars. The spacecraft is supposed to photograph the surface of the planet and radio the pictures to earth.

The U.S. in March sent a 36-inch telescope up to 80,000 feet by balloon to photograph Mars. But the pictures it took did not immediately reveal anything we didn't know.

What do we know? We know that Mars is a very dry planet, mostly red in color but with blue-green regions that may indicate plant life. It has poles covered with ice or snow. It also has a network of lines cross-crossing its surface. Scientists once thought they were canals, but it's thought now that they may be natural features. We also know that Mars is about half the size of the earth. And it has seasons, as our planet does, but they're about twice as long as ours because it takes Mars twice as long

to go around the sun. Yet, like the earth, Mars turns on its axis about every 24 hours.

Martians? Scientists figure it'll be momentous news if it can be shown there's even the most rudimentary life there.

P.S. America is planning a Mars shot next year, at the earliest. When will we land on Mars? At last report, that won't be until the 1980's.

Will the U.S. and Russia join together in the exploration of space? The U.S. is willing and Russia recently agreed to coordinate the launching of weather satellites with ours. But the two don't agree on broad policies. The consensus: The race to the moon is still on. (In early April, a Red moon shot evidently missed the mark.) As the space programs grow in complexity, however, so the two nations will move closer together.

Latest chapter in the cancer-research story: American scientists have begun a crash program to check the relationship between cancer and viruses (see story on page 31). They know that viruses cause various cancers in animals. And they strongly suspect the same holds true in human cases. Now four institutions will work together to prove their suspicions. A cancer-virus link was first suggested by a French scientist 60 years ago. But many who pooh-poohed his theory have now come around to his view.

Rachel Carson's book "Silent Spring" has made this season one of the noisiest springs of any year. The debate on pesticides, which the Government has now entered, has pitted extremist versus extremist--among naturalists and humanists and among chemical industry spokesmen. The outlook: Pesticide use is going to be closely controlled from now on. Should you use pesticides? Say the experts: Only with utmost caution.

Life in the year 2000: A middle-income family will have $11,000 a year to spend. The U.S. population will be over 330 million. Something like 244 million cars will be rolling along the country's roads and streets. So says a report by a Ford Foundation organization called Resources for the Future. Its message: We've got to prepare for this vastly bigger U.S. now. How? By conserving land for play, travel and living space. By developing water resources in the West, cleaning them up in the East. By stimulating foreign trade, stepping up research and development.
Food for thought: A 37-year-old native American, when he was born, had only 115 million countrymen. At the age of 74, he will have seen the U.S. population triple.

Look for a vigorous new drive to increase America's scientific manpower. Symbol of the new campaign is Dr. Leland J. Haworth, recently appointed director of the National Science Foundation. The

foundation is a Federal agency set up in 1951 to support basic research and education in the sciences. A former member of the Atomic Energy Commission, Dr. Haworth worked closely with AEC Chairman Dr. Glenn T. Seaborg--so closely, in fact, that other AEC members complained they weren't consulted.

Nuclear-powered ships will soon be world-wide. Japan will spend over $16 million to launch a 6,350-ton atom vessel by 1969. And Britain is going ahead with its plans for a nuclear fleet, despite a row about how safe its seagoing reactors are. The U.S. and the Soviet Union already have a variety of nuclear-powered vessels.

Naval note: Despite the "Thresher" tragedy, new major vessels of the U.S. Navy will be nuclear-powered, if a Navy Secretary proposal is OK'd.

If your city is on a body of water, you may soon be able to beat the traffic by riding a hydrofoil. A boat bus that moves on skis has been tested on New York's East River. Seating 22 people, it covered 14 miles in 38 minutes, at cruising speed. Future models will seat 200, with speeds up to 100 mph. Regular service in the New York area will begin in July. In Boston, Philadelphia and the Great Lakes areas, hydrobuses will soon go into service too. And Seattle plans a hydroferry to Vancouver. The distance is 75 miles; the trip will take 80 minutes.

Why do women live longer than men? A Cornell University professor has found that the male hormone shortens life in both sexes and the female hormone prolongs life in males--among rats, that is....Add another particle to the growing list of man-made atomic subdivisions known as mesons. It's called a Phi-meson. Over 60 such particles have been found so far.... If you still think that atomic tests affect the weather, the answer again, from the World Health Organization, is--NO....Scientists welcome the AEC's decision to give the Fermi Award to Dr. J. Robert Oppenheimer. The American Association for the Advancement of Science magazine "Science" says the U.S. "has shown it can recognize unusual merit regardless of controversy."

Measles vaccines have been OK'd, but there's still more to learn about them. A Government report says "it is important to determine the durability of immunity." Doctors should also check "significant adverse reactions." Who should get the vaccine? All children over nine months old, officials say.

QUOTE OF THE MONTH: "We have been successful in keeping the secrets of nuclear weapons (from) the American public, but I fear the Russians have all the secrets known to us, (even) those we are going to discover."--Dr. Edward Teller, "Father of the H-bomb."

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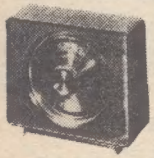

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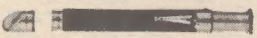

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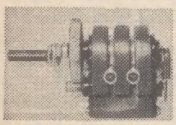

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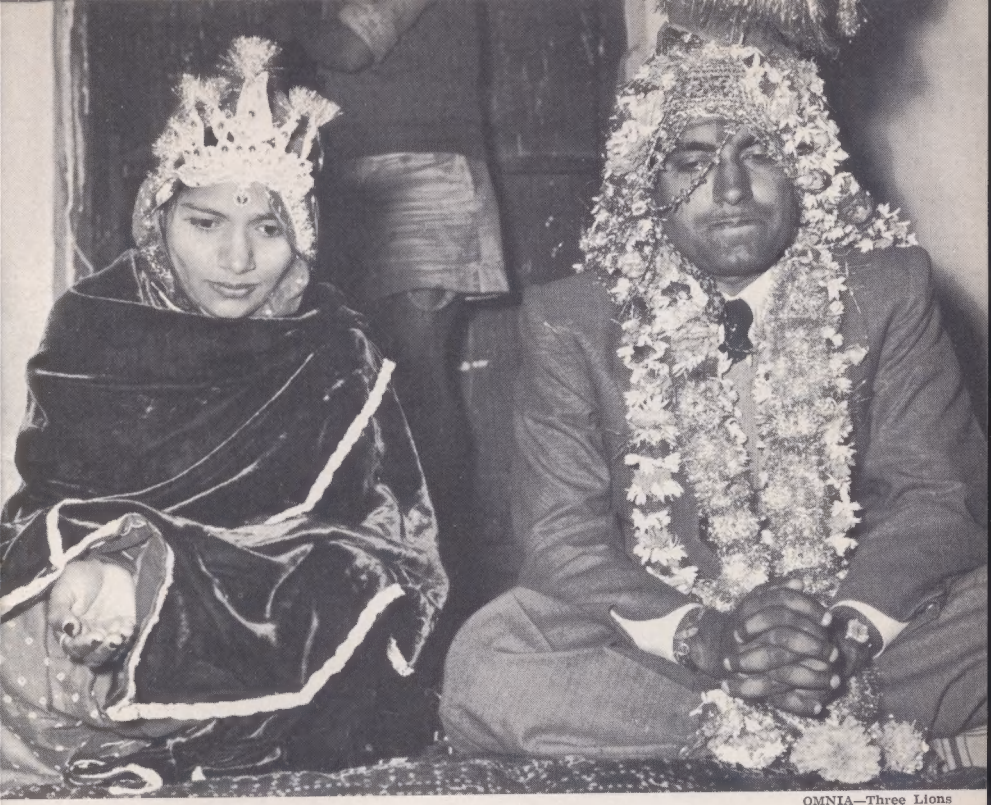


OMNIA—Three Lions

When strangers marry

THIS young Hindu couple is meeting for the first time.

Both have been betrothed since they were youngsters upon the agreement of their parents, but they have not seen each other until the day of the marriage. Even then the bride does not look at her husband-to-be until a few minutes before the ceremony, and during the ritual, custom forbids her from gazing upon him.

In Indian marriages the groom is more elaborately dressed than the bride, wearing a lavish, towering crown and garlands of flowers.

If these customs seem strange to the West there is one part of the wedding that should be all too familiar—the cost. The bride's father may nearly ruin himself paying for the festivities. Five hundred guests is not an unusual number.

Before the ceremony the bride dines quietly with female friends and relations, while the groom indulges in more elaborate festivities with his male associates.

Most guests leave after the meal and only close relatives attend the ceremony, which can last as long as six to eight hours.

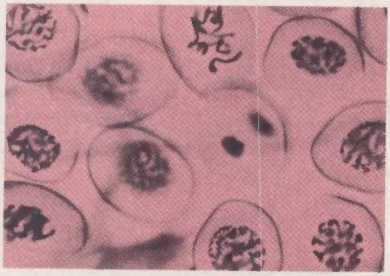
In this issue . . .

Almost 2000 years ago the people of Japan surrounded graves with clay statues called haniwa. A close look at these statues leads to the conclusion that people are the same the world over. Page 52.

The short guy plays an important part in building our number one weapon. Page 74.

Today cameras are getting so complicated that even the gadgets have gadgets, and more are being added every day. How can the casual photographer ever find his way through the maze of "improvements" and get the camera that is best for his needs? Page 16.

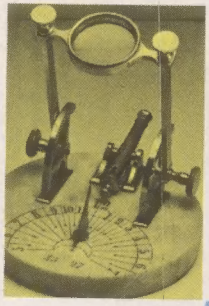
Peter Kapitsa has been able to stand up to both Stalin and Khrushchev. Why is he so important? Page 45.



Cells are the basic units of all living things, and the thread-like chromosomes within the cells carry our hereditary characteristics. Only by understanding these basic units will we ever know why living things live. Page 69.

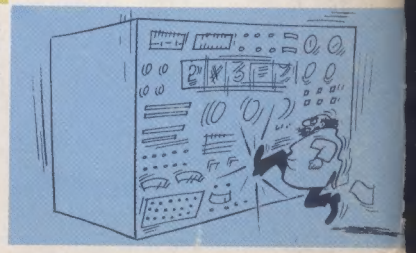
Progress and ingenuity are not exclusive characteristics of the twentieth century. The Egyptians developed the Astrolobe some 2,000 years ago. It is just one of the scientific devices that turn up in the movie "Cleopatra." Page 5.

This little fellow is biting the hand that feeds him. Not all white rats act this way, however. Page 79.



At noon the cannon goes off. This early alarm "clock" is just one of an astounding variety of sundials. Page 84.

Every once in a while we all feel like this. But machines are all around us and we can't let them get us down. Page 26.



Dr. Eleanor Maccoby asks the question, are women really mentally inferior or do they just act that way because it is expected of them? Page 21.